
Radial Oil Seal







■ RADIAL OIL SEAL

■ The Seal

General

Rotary shaft lip seals are components designed in a ring form, fitted between machine parts in relative rotation, with the function of separating oil or grease from the inside and dirt, dust, water etc. from the outside.

The rotary shaft seals are generally composed of an elastomeric diaphragm, shaped in a "lip form" and reinforced with a co-vulcanized metal insert. The sealing lip is energized with a "Garter Spring".

Seal design

The sealing lip design corresponds to the current state of art and is based on many years of experience in a wide range of application fields.

The sealing edge can either be ready molded or trimmed by mechanical cutting.

The total radial force of the sealing lip is given by elastomer pre-tension together with tensile spring force. The former depends on the deformation and elasticity of the rubber material, geometry of the sealing lip and interference between shaft and seal.

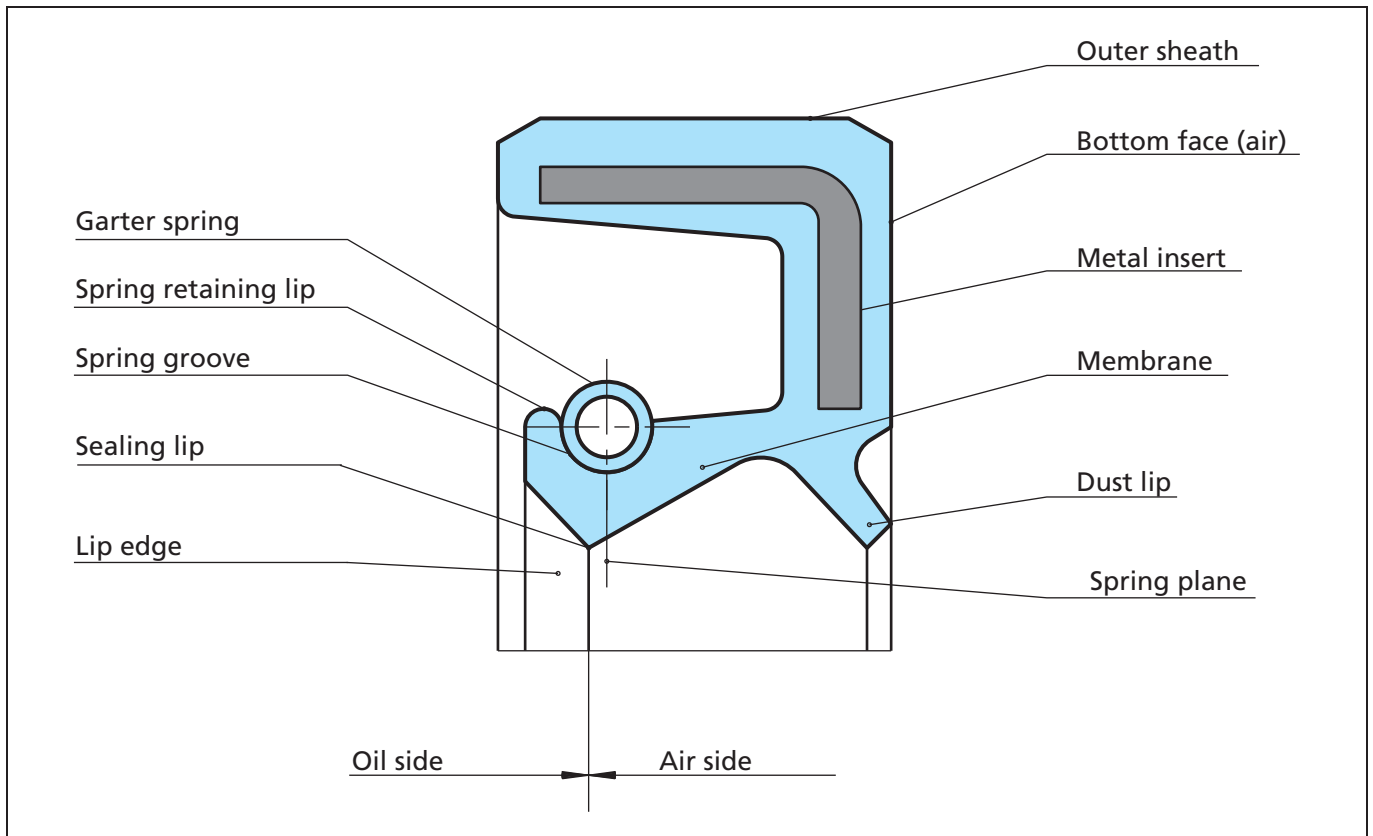


Figure 1 Designation for Rotary shaft lip seals (extract from ISO 6194)



Radial Oil Seal

Seal design

Outer sheath

Can be either flat or wavy, fitting in both cases into ISO H8 bore and the tolerance of the outer sheath is according ISO 6194-1.

Metal insert

Is normally made of cold rolled steel sheet AISI 1008, DIN 1624. Environmental conditions may require another material, such as stainless steel AISI 304, DIN 1.4301.

If the seal is not rubber covered as for the seal type TRC, TRD, TRB and TRF, the metal insert O.D. tolerance is also according ISO 6194-1. On request the O.D. can be delivered with sealing agent.

The case is normally made of cold rolled steel sheet AISI 1008, DIN 1624. Environmental conditions may dictate other materials, such as brass or stainless steel AISI 304, DIN 1.4301.

Table I Tolerance according ISO 6194-1

Nominal outside diameter d_2	Diametral tolerance	
	Metal cased	Rubber covered
$D_2 \leq 50$	+ 0.20	+ 0.30
	+ 0.08	+ 0.15
$50 < D_2 \leq 80$	+ 0.23	+ 0.35
	+ 0.09	+ 0.20
$80 < D_2 \leq 120$	+ 0.25	+ 0.35
	+ 0.10	+ 0.20
$120 < D_2 \leq 180$	+ 0.28	+ 0.45
	+ 0.12	+ 0.25
$180 < D_2 \leq 300$	+ 0.35	+ 0.45
	+ 0.15	+ 0.25
$300 < D_2 \leq 530$	+ 0.45	+ 0.55
	+ 0.20	+ 0.30

Garter spring

Function

When rubber is exposed to heat, load or chemical action, it will gradually lose its original properties. The rubber is then said to have aged. The original radial force exerted by the sealing element will then diminish. The function of the garter spring is therefore to maintain the radial force.

Experiments have shown that the radial force must vary with the size and type of seal. Experiments have also clearly indicated the significance of maintaining changes in the radial force within narrow limits during the service life of the seal. Extensive investigations in the laboratory have formed the basis for defining the radial force.

The garter spring is closely wound and carries an initial tension. The total force exerted by the spring consists of the force required to overcome the initial tension and the force due to the spring rate. The use of a garter spring with initial tension provides the following advantages:

- as the sealing element wears, the total radial force from the initial tension will not change.
- by eliminating some of the initial tension by heat treatment, it can be adjusted to achieve the required radial force for the actual shaft diameter.
- the heat treatment of the spring takes place at a temperature above the operating thermal level of the seal, thus ensuring that the spring force will be stabilized. This procedure eliminates the risk that the original spring force will change during service.

Material

Spring steel SAE 1074, DIN 17223 is normally employed. If resistance to corrosion is required stainless steel AISI 304, DIN 1.4301 is used. Garter springs of bronze or similar materials are not recommended, since they tend to fatigue after long service life or as a result of exposure to high temperatures. In special cases the garter spring can be protected against fouling by means of a thin rubber hose.



■ Design instruction Shaft

Shaft

Surface finish, hardness and machining methods

The shaft design is of vital significance for the performance as well as for the useful life of the seal (see Figure 4). As a basic principle, the hardness of the shaft should be higher as peripheral speeds increase. The Standard DIN 3760 specifies that the shaft must be hardened at least 45 HRC.

As the peripheral speeds increase, the hardness must be increased and at 10 m/s a hardness of 60 HRC is required. The choice of a suitable hardness is dependent not only on the peripheral speed but also on such factors as lubrication and the presence of abrasive particles. Poor lubrication and difficult environmental conditions require a higher hardness of the shaft. DIN 3760 specifies a surface roughness of $R_t=1\ \mu\text{m}$ to $4\ \mu\text{m}$. Laboratory tests have however proved that the most suitable roughness is $R_t=2\ \mu\text{m}$ ($R_a=0.3\ \mu\text{m}$). Rougher as well as smoother surfaces generate higher friction, resulting in increased temperature and wear. We suggest a surface roughness of $R_t=2-3\ \mu\text{m}$ ($R_a=0.2-0.8\ \mu\text{m}$).

Measurements of friction and temperature have also shown that grinding of the shaft is the best method of machining. However spiral grinding marks may cause a pumping effect and leakage and plunge grinding should therefore be applied, during which even ratios between grinding wheel speed and work-piece should be avoided. Polishing of the shaft surface with polishing cloth produces a surface which causes higher friction and heat generated as compared with plunge grinding. In certain cases it maybe impossible to provide the necessary hardness, surface finish and corrosion resistance of the shaft. This problem can be solved by fitting a separate sleeve onto the shaft. If wear should occur, only the sleeve need to be replaced (see the chapter "Shaft Repair Kit").

Shaft run out

Shaft run out should as far as possible be avoided or kept within a minimum. At higher speeds there is a risk that the inertia of the sealing lip prevents it from following the shaft movement. The seal must be located next to the bearing and the bearing play be maintained at the minimum value possible. See Figure 2.

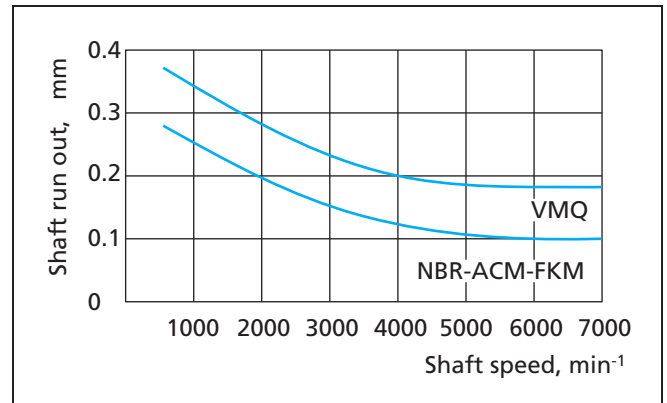


Figure 2 Shaft run out

Eccentricity

Eccentricity between shaft and housing bore centers should be avoided in order to eliminate unilateral load of the lip. See Figure 3.

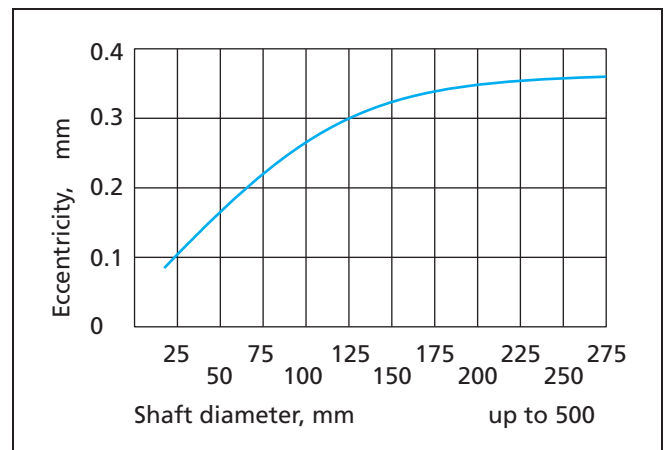


Figure 3 Eccentricity



Radial Oil Seal

Design instruction Shaft

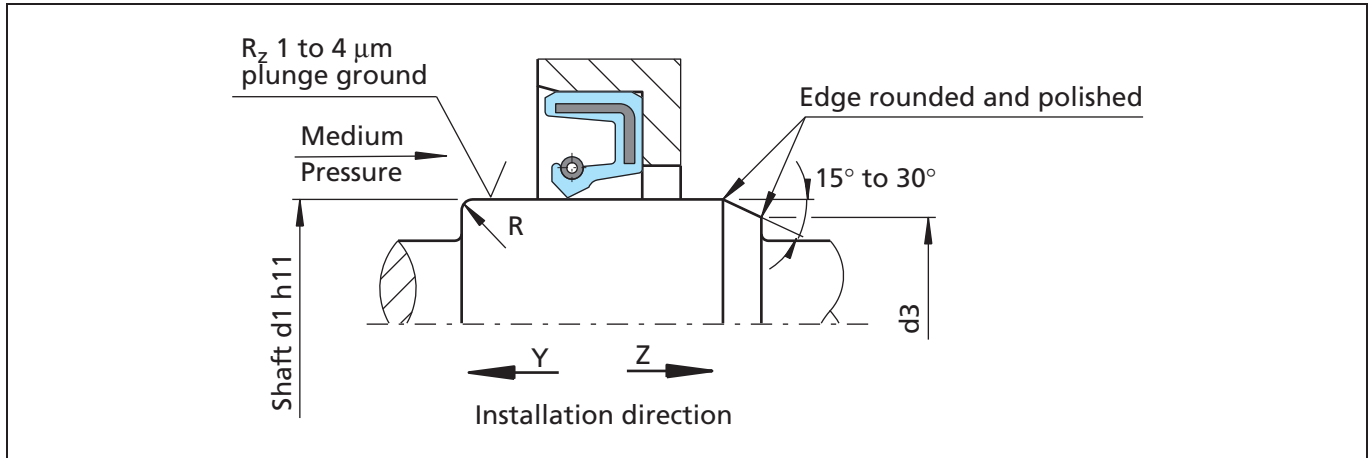


Figure 4 Installation of the Radial Oil Seal

Depending on the installation direction (Y or Z), a chamfer or radius on the shaft is recommended. The dimensions for this are shown in Figure 4 and Table II.

Table II Chamfer length for shaft end

d_1	d_3	R
< 10	$d_1 - 1.5$	2
over 10 to 20	$d_1 - 2.0$	2
over 20 to 30	$d_1 - 2.5$	3
over 30 to 40	$d_1 - 3.0$	3
over 40 to 50	$d_1 - 3.5$	4
over 50 to 70	$d_1 - 4.0$	4
over 70 to 95	$d_1 - 4.5$	5
over 95 to 130	$d_1 - 5.5$	6
over 130 to 240	$d_1 - 7.0$	8
over 240 to 500	$d_1 - 11.0$	12

Characteristics of the shaft surface

The running surface for oil seals is specified in DIN 3760/61. The surface should meet the following requirements:

Surface roughness	R_a	= 0.2 to 0.8 μm
	R_z	= 1 to 4 μm
	R_{max}	= 6.3 μm
Hardness	55 HRC or 600 HV, hardness depth min. 0.3 mm	

Surface roughness

The functional reliability and service life of a seal depends to a very great extent on the quality and surface finish of the mating surface to be sealed. Scores, scratches, pores, concentric or spiral machining marks are not permitted. Higher demands must be made on the surface finish of dynamic mating surfaces than to static mating surfaces.

The characteristics most frequently used to describe the surface microfinish, R_a , R_z and R_{max} , are defined in ISO 4287. These characteristics alone, however, are not sufficient for assessing the suitability in seal engineering. In addition, the material contact area R_{mr} in accordance with ISO 4287 should be considered. The significance of these surface specifications is illustrated in Figure 5. It shows clearly that specification of R_a or R_z alone does not describe the profile form accurately enough and is thus not sufficient for assessing suitability in seal engineering.

The material contact area R_{mr} is essential for assessing surfaces, as this parameter is determined by the specific profile form. This in turn is directly depending on the machining process employed.

Surface profile	R_a	R_z	R_{mr}
closed profile form 	0.1	1.0	70%
open profile form 	0.2	1.0	15%

Figure 5 Profile forms of surfaces



Design instruction Housing bore

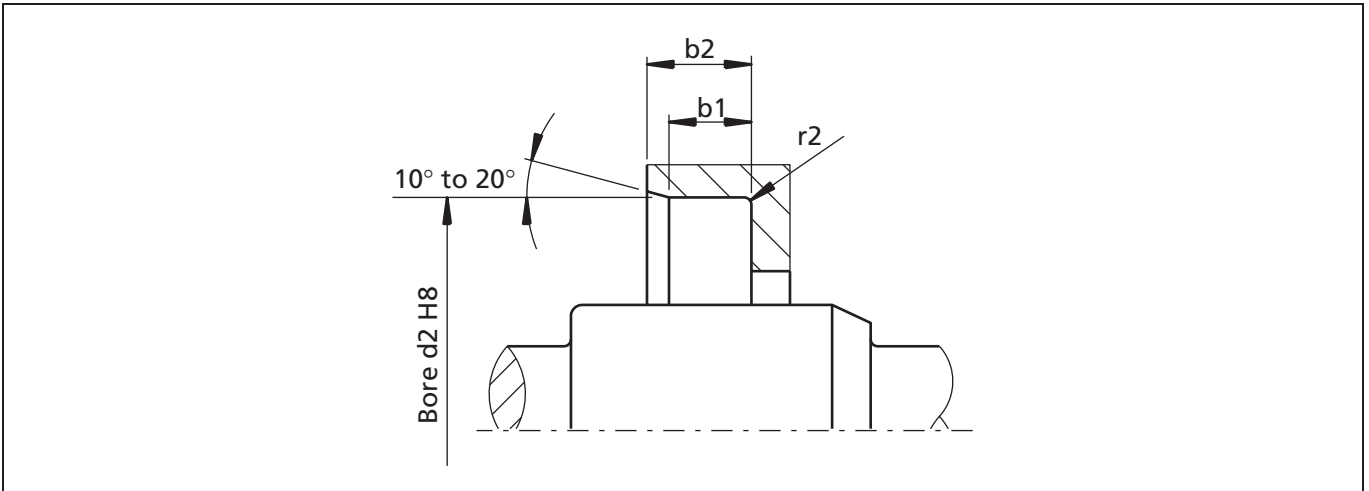


Figure 6 Installation depth and lead-in chamfer

Housing bore

For metric sizes the tolerances are in accordance with the German Standard DIN 3760 which provides a suitable press fit for the bore tolerance ISO H8. The inch sizes are in accordance with American Standards. In cases where the housing bore has a different tolerance the seal can be made to a suitable size. For bearing housings made of soft materials, e.g. light metals, and for bearing housings with thin walls, a special fit between the seal and the housing may be necessary. The tolerances for the seal and housing should then be determined by practical assembly trials. If a component such as a bearing is assembled through the housing bore for the seal, the bore may be damaged. In order to avoid damaging the bore, a seal with a larger outside diameter than that of the bearing should be selected.

Surface roughness of the housing

Values for the surface roughness in the gland are specified in ISO 6194/1.

General values:	R_a	=	1.6	-	6.3	μm
	R_z	=	10	-	20	μm
	R_{max}	=	16	-	25	μm

For metal/metal sealing or gas sealing, a good score-free and spiral-free surface finish is necessary. If the rotary shaft lip seal is bonded into the housing, ensure that no adhesive comes into contact with the sealing lip or the shaft.

Table III Housing dimensions

Ring Width b	b_1 ($0.85 \times b$) mm	b_2 ($b + 0.3$) mm	r_2 max.
7	5.95	7.3	0.5
8	6.80	8.3	
10	8.50	10.3	
12	10.30	12.3	0.7
15	12.75	15.3	
20	17.00	20.3	



Radial Oil Seal

Installation instructions

The following points must be observed when installing rotary shaft lip seals:

- Before installing, clean the installation grooves. Shaft and seal must be greased or oiled for rubber seals
- Sharp-edged transitions must either be chamfered or rounded or else covered
- When pressing in the seal, take care that the seal ring is not twisted
- The pressing force must be applied as close as possible to the outer circumference of the seal
- After installation, the seal must be concentric and at right angles to the shaft
- The end face of the mounting bore is generally used as the contact surface; the seal can also be fixed with a shoulder or a spacer washer.

Figure 7 shows various force fit situations of the rotary shaft lip seal with suitable installation tools or devices.

Dismantling and replacement

The dismantling of seals does not normally present any problems. A screwdriver or similar tool can generally be used. The seal will then be deformed. After repair or maintenance of a machine a new rotary shaft lip seal must always be installed, even if the old ones seem to be still usable. The sealing edge of the new seal must not ride on the old contact area on the shaft. This can be achieved by:

- replacement of shaft sleeves
- fitting the seal into the bore to a different depth
- rework of the shaft and assemble a wear sleeve (see the chapter "Shaft Repair Kit").

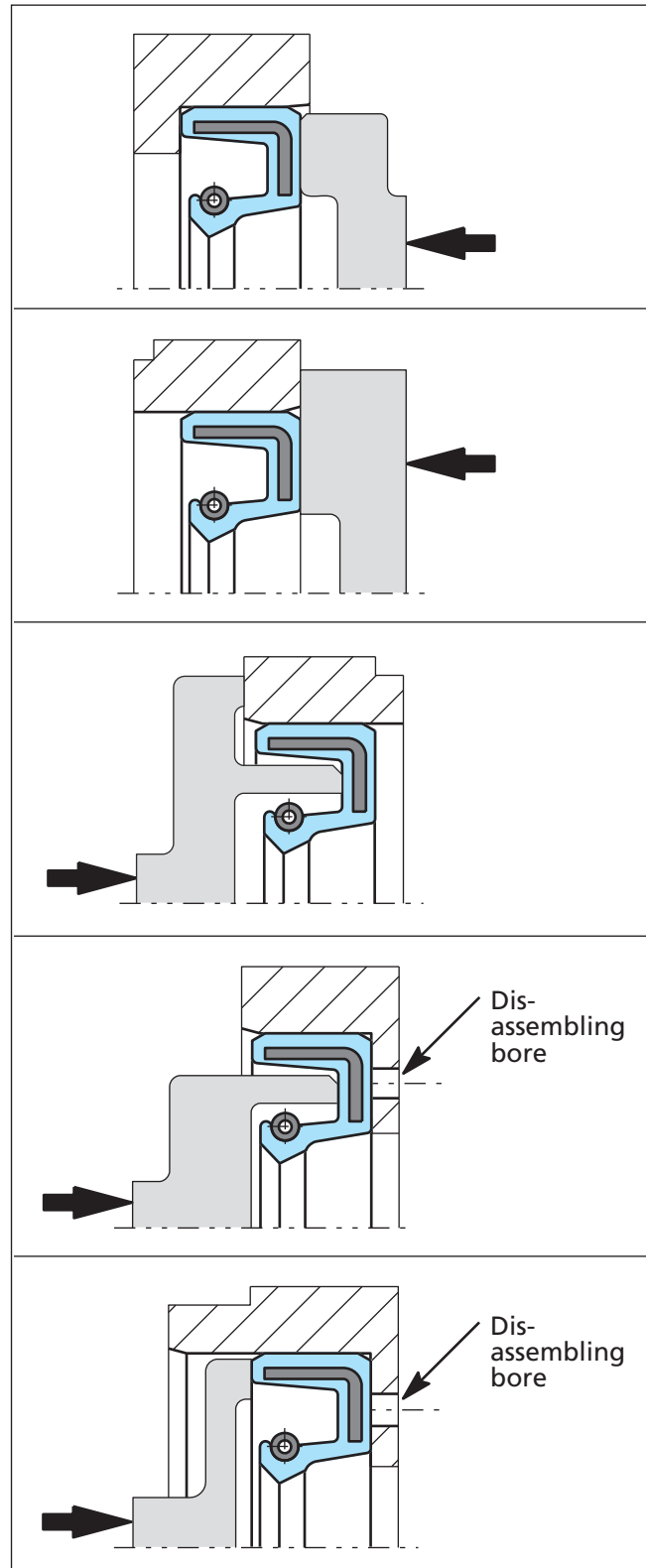


Figure 7 Installation aids for fitting rotary shaft lip seals



Sealing element

Compound

The material selected must take into account environmental conditions and function requirements.

Some of the requirements associated with environmental considerations are:

- Good chemical resistance
- Good resistance to heat and low temperature
- Good resistance to ozone and weathering

The functional demands include:

- High resistance to wear
- Low friction
- Low compression set
- Good elasticity

In addition, cost considerations render ease of processing a desirable feature. Trelleborg Sealing Solutions can supply the optimum material for each application.

To identify this contact your local Trelleborg Sealing Solutions marketing company.

Type and designations of materials

Nitrile rubber	(NBR)
Acrylic rubber	(ACM)
Silicone rubber	(VMQ)
Fluorinated rubber	(FKM)
Hydrogenated Nitrile rubber	(HNBR)

A further development of the Nitrile rubber has led to the so called hydrogenated Nitrile rubber (HNBR). The heat and ozone resistance is significantly better. This material can replace Acrylic rubber and in certain cases also Fluorinated rubber. In order to satisfy the wide range of demands made on seals, a special composition has been developed for each type of rubber. Other compositions are also available to meet some extreme requirements.

Table IV Material recommendations

Materials for sealing common media		Material designation				
		Acrylonitrile Butadiene Rubber NBR	Fluorocarbon Rubber FKM	Polyacrylate Rubber ACM	Silicone Rubber VMQ	Hydrogenated Acrylonitrile Butadiene Rubber HNBR
		Material Abbreviation				
		N	V	A	S	H
		Max. permissible constant temperature (°C)				
Mineral fluids	Engine oils	100	170	125	150	130
	Transmission oils	80	150	125	130	110
	Hypoid transmission oils	80	150	125	--	110
	ATF oils	100	170	125	--	130
	Hydraulic fluids (DIN 51524)	90	150	120	--	130
	Greases	90	--	--	--	100
Flame retardant hydraulic fluids (VDMA 24317) (VDMA 24320)	Oil-water emulsion	70	--	--	60	70
	Water-oil emulsion	70	--	--	60	70
	Aqueous solutions	70	--	--	--	70
	Water-free fluids	--	150	--	--	--
Other media	Fuel oils	90	--	--	--	100
	Water	90	100	--	--	100
	Lyes	90	100	--	--	100
	Air	100	200	150	200	130

Due to the different configurations of the media, the above-mentioned temperature ranges are for guidance only. Depending on the medium, significant deviations may occur.



Radial Oil Seal

Description of rubber materials

Nitrile Rubber (NBR)

Advantages:

- Good oil resistance
- Good heat resistance up to 100°C in oil
- High tensile strength (special compounds over 20 MPa)
- High elongation at break
- Low swelling in water

Limitations:

- Poor weather and ozone resistance
- Poor resistance against polar fluids (ester, ether, ketones and aniline)
- Poor resistance against chlorinated hydrocarbons (carbon tetrachloride, trichlorethylene)
- Poor resistance against aromatic fluids (e.g. benzene, toluene)

Fluids, mineral oils and above all high-alloyed mineral oils (hypoid oils) containing larger quantities of aromatic hydrocarbons have a high swelling effect on NBR-compounds. The swelling behavior can be improved by increasing the acrylonitrile content.

However an inferior cold flexibility and resistance to compression set must be accepted. The additives in high-alloyed oils can in certain cases cause an additional interaction between the elastomer and the additive, thus influencing the elasticity.

Hydrogenated Nitrile Rubber (HNBR)

Advantages:

- Good oil resistance, also in hypoid oils
- Good heat resistance, up to + 150 °C
- Good mechanical properties
- Good weather and ozone resistance

Limitations:

- Poor resistance against polar fluids (esters, ethers, ketones and aniline)
- Poor resistance against chlorinated hydrocarbons (carbon tetrachloride, trichlorethylene)
- Poor resistance against aromatic fluids (bensene, toluene)

Polyacrylic Rubber (ACM)

Advantages:

- Good resistance against oils and fuels (better than Nitrile rubber)
- Heat resistance about 50 °C better than for Nitrile rubber, 150 °C in oil and 125 °C in air
- Good weather and ozone resistance

Limitations:

- Not usable in contact with water and water solutions, even smaller quantities of water in oil
- Limited cold flexibility to about -20 °C, somewhat poorer than normal NBR
- Limited tensile strength and tear resistance, especially above 100 °C
- Poor wear resistance (considerably inferior compared to NBR)
- Poor resistance against polar and aromatic fluids and chlorinated hydrocarbons



Fluorinated Rubber (FKM)

Advantages:

- The resistance against oils and fuels is better than for any other rubber type
- The only highly elastic rubber material, which is resistant to aromatic and chlorinated hydrocarbons
- Excellent heat resistance, the best one after silicone rubber, up to 200°C
- Excellent weather and ozone resistance
- Excellent acid resistance (only inorganic acids, not suitable for organic acids e.g. acetic acid)

Limitations:

- Limited cold flexibility, to approx. -20°C to -25°C
- Limited tensile and tear strength, especially above 100°C
- High compression set in hot water
- Poor resistance to polar solvents

Silicone Rubber (VMQ)

Advantages:

- Best heat resistance of all rubber types
- Best cold resistance of all rubber types
- Excellent weather and ozone resistance
- Resistant against aliphatic mineral oils and most grease types

Limitations:

- Poor tensile and tear strength for standard compounds
- Poor wear resistance
- Poor resistance against aromatic oils and oxidized mineral oils
- Poor diffusion resistance



Radial Oil Seal

Working parameters

Temperature resistance

Increasing temperature accelerates the aging of the rubber, the material becomes hard and brittle, the elongation decreases and the compression set increases. Axial cracks at the sealing edge are a typical indication that the seal has been exposed to excessively high temperature.

The aging of the rubber has appreciable significance on the useful life of the seal. The temperature limits for the principal materials are illustrated in Figure 8. They should only be regarded as approximate, since the materials are also affected by contact media. It can generally be said that a temperature increase of 10°C (in air) will halve the theoretical useful life of the rubber.

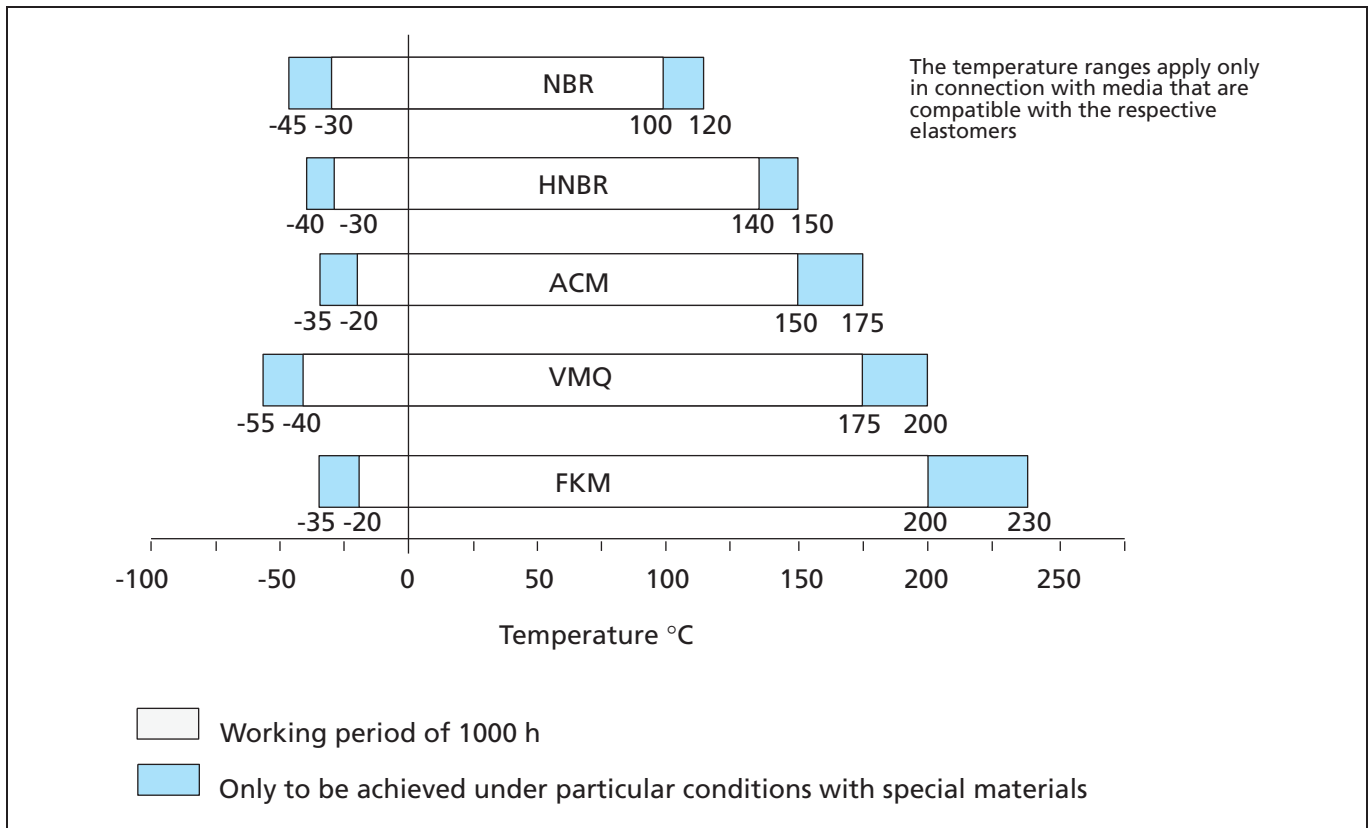


Figure 8 Temperature limits for some common types of rubber

Temperature

Temperature is the most critical criteria to be considered when selecting a rotary seal.

The temperature limits indicated in the selection tables are maximum operating temperatures of the sealing material in fluids to which the sealing material is compatible (good chemical resistance and controlled swelling/shrinkage).

The above descriptions show that the temperature in the sealing area is influenced by various parameters especially:

- The lubricating capability of the fluid and its ability to dissipate the heat generated under the sealing lip.
- The circumferential velocity
- The pressure applied

The resulting temperature in the sealing area must be considered to select the appropriate material. The initial temperature of the fluid can increase by up to 50% depending on operating parameters. For all applications please refer to the recommendations in the various chapters and contact your local Trelleborg Sealing Solutions marketing company.



Working parameters

Overpressure

When the sealing element is exposed to pressure it is forced against the shaft and the area of the lip in contact with the shaft increases. The friction as well as the generated heat, increases. As a result, when the seal is under pressure, the specified values of peripheral speed cannot be maintained but must be reduced in relation to the magnitude of the pressure. At high peripheral speeds even overpressures of 0.01 to 0.02 MPa may cause difficulties. By fitting a separate back-up ring the types (TRA, TRC, TRB) can be used for overpressure above 0.05 MPa. The separate back-up ring shape follows the rear profile of the sealing element but without mutual contact when no pressure differential exists. See Figure 9. However, the back-up ring requires accurate fitting.

Please ask your local Trelleborg Sealing Solutions marketing company for suitable back-up ring drawing. Seal type TRU is formed to support the sealing element. See Figure 9. The type TRP/6CC is designed with a short and sturdy sealing lip, which allows overpressures without using a separate back-up ring. When a back-up ring is installed or when the types TRU, TRP/6CC are used, overpressures of 0.4 to 0.5 MPa are permissible at moderate peripheral speeds.

At very high pressures, the seals with rubber-covered cases should be employed in order to avoid leakage between the periphery of the seal and the housing bore. When the seal is under pressure there is a risk of axial movement in the housing bore (pop-out). This effect can be prevented by locating the seal against a shoulder, with a spacer ring or a circlip.

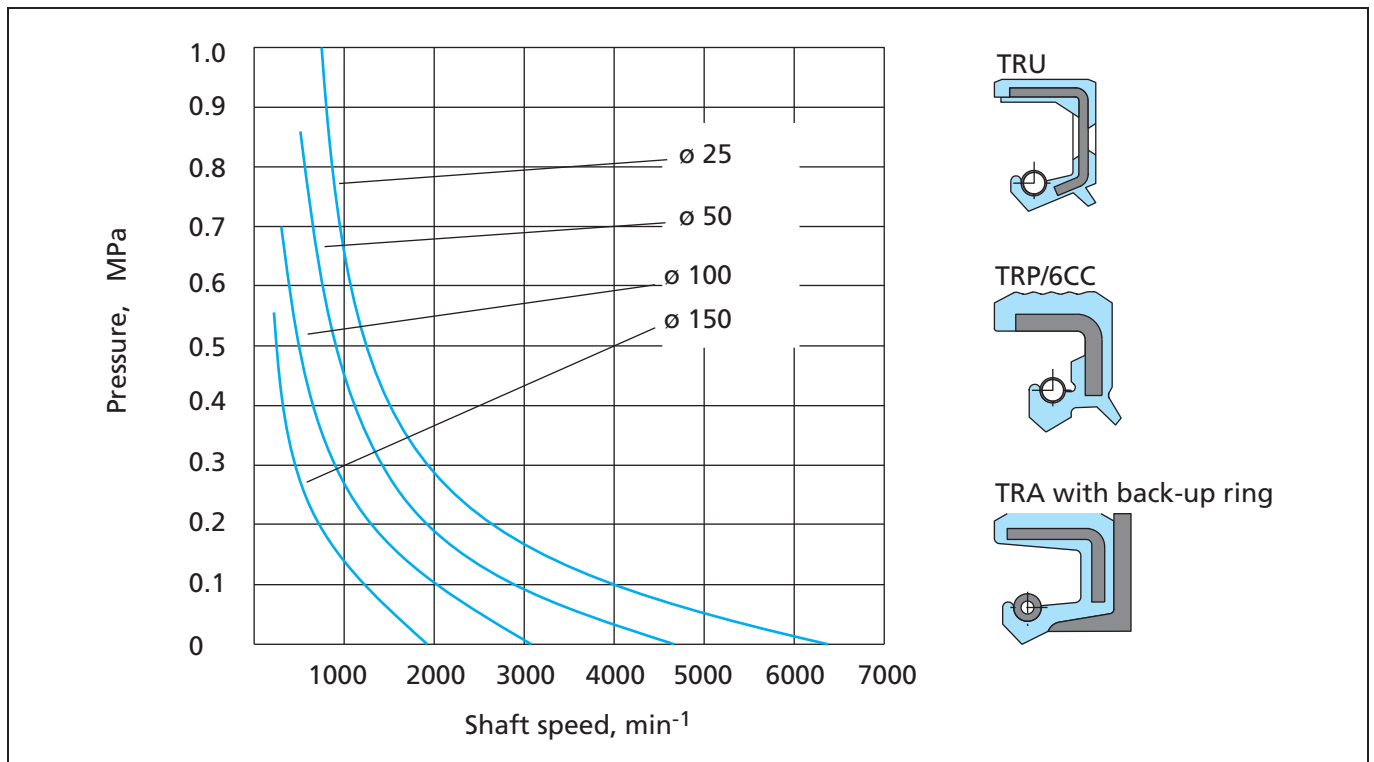


Figure 9 Permissible overpressure for supported lip seals and for pressure seals



Radial Oil Seal

Working parameters

Peripheral speed and number of revolutions

Different designs of the sealing element affect the magnitude of the friction and thus result in varying temperature rises. Various designs of the sealing element allow different maximum peripheral speeds. Figure 10 shows the approximate maximum values for the permissible peripheral speed for sealing elements (without dust lip), i.e. seal type TRC, TRA, TRB, etc, made with materials NBR, ACM, FKM and VMQ, with no

differential pressure, and where adequate lubrication or cooling of the sealing edge by the sealed medium exists. In addition the maximum permissible operating temperatures shown in table IV must not be exceeded. The curve shows that higher peripheral speeds are permissible for larger shaft diameters more than for the smaller. This is due to the fact that the cross-sectional area increases in proportion to the square of the diameter, thus increasing the heat dissipation capacity.

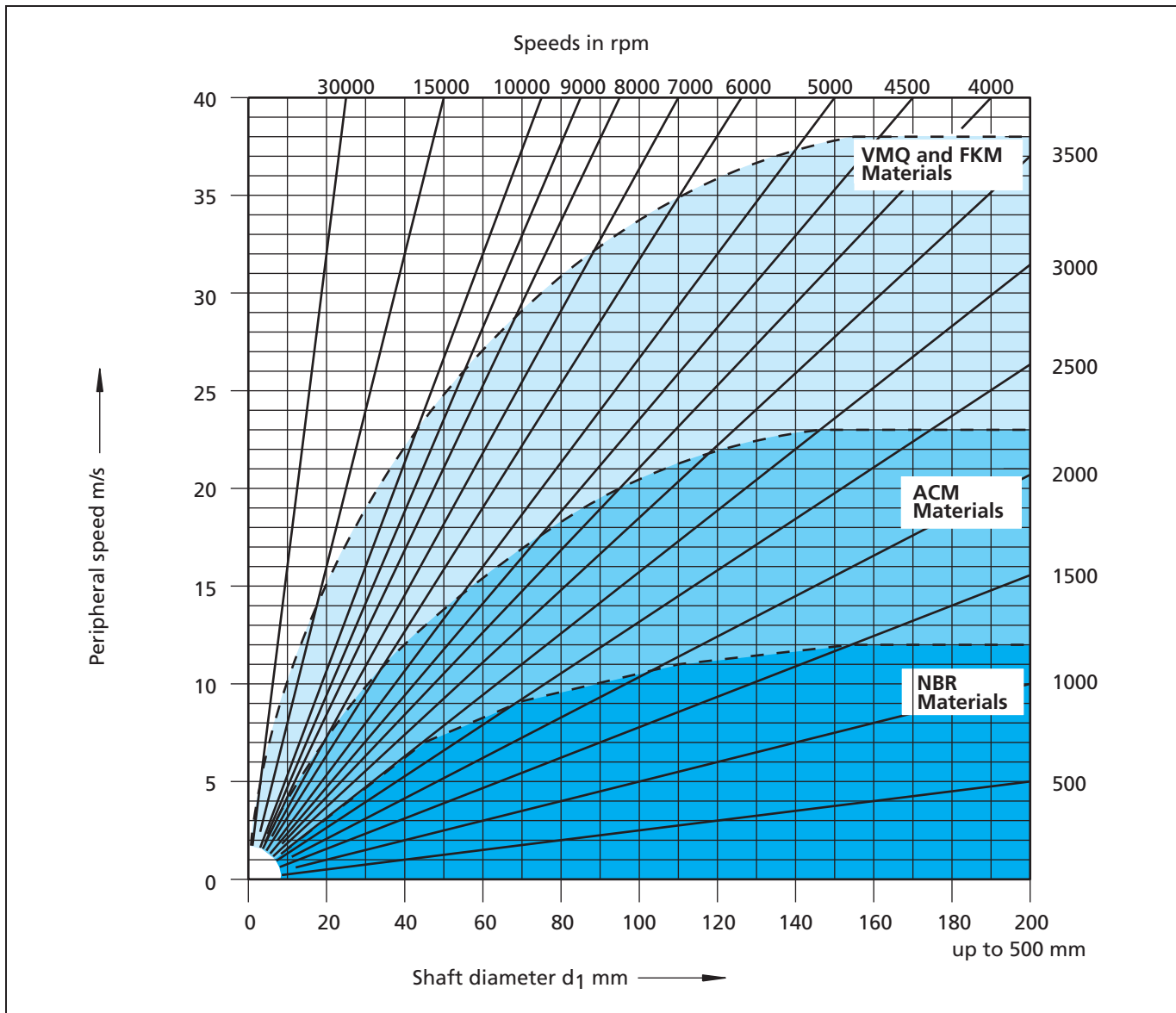


Figure 10 Permissible speeds in pressure-free state to DIN 3761



Working parameters

Frictional loss

The frictional loss is often of significant magnitude, particularly when low powers are transmitted. The frictional loss is affected by the following parameters: seal design and material, spring force, speed, temperature, medium, shaft design, and lubrication. Figure 11 shows the frictional losses in watts caused by a seal without dust lip when fitted in accordance with our technical instructions. In certain cases the frictional loss can be reduced by a special design of the sealing lip, reduction of the spring force or by employing a special grade of rubber. Our technical department will be pleased to provide advice on such matters. It should be noted that the frictional loss during the "running in" period is greater than shown in the figure. The normal "running in" period is a few hours.

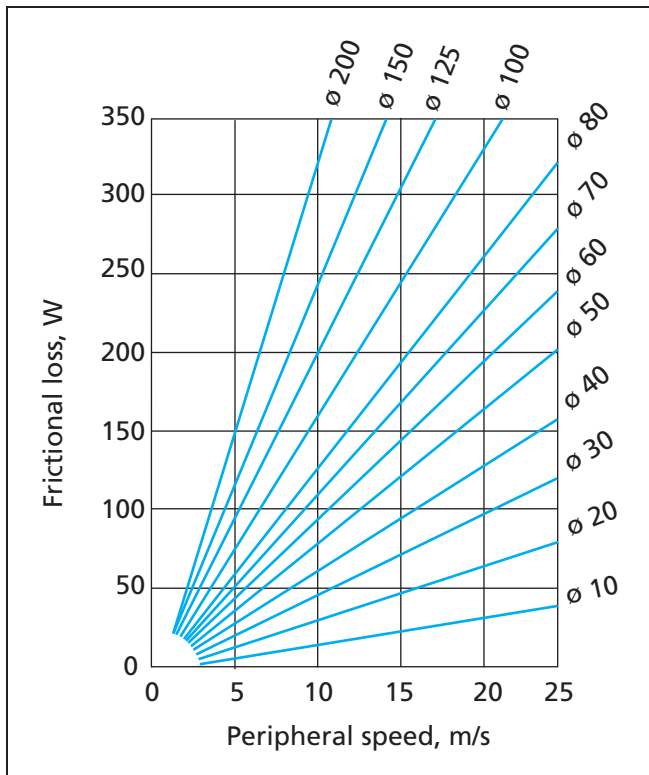


Figure 11 Frictional loss for TRA type seal of Nitrile rubber

Leakage control

When defining leakage control one must differentiate between static sealing (sealing of two surfaces without motion relative to one another) and dynamic sealing (relative motion between the two surfaces).

With a moving seal surface, a fluid film separates the sliding surfaces from one another; a dynamic seal gap forms. Unlike in static sealing, the leakage path is not fully closed off, so small quantities may escape. Seals in which a dynamic seal gap forms between the seal body and a rotating shaft cannot be tight in the physical sense.

Absolute tightness in the physical sense cannot be achieved with a seal gap alone when sealing moving parts.

For many technical applications, however, it is quite adequate if the "leakage" is reduced to such an extent that there are no negative consequences for the environment or the operation of the assembly. This is called technical tightness.

Technical tightness must be specified by the user or manufacturer of an assembly, i.e. in some circumstances maximum permitted leakage rates must be defined.

For example, leakage classes are defined for oil seals in DIN 3761 Part II (Motor vehicles).

The German standard DIN 3761 classifies the tightness of lip seals into leakage classes 1 to 3. A so called zero-leakage is also defined. Zero-leakage means a function related film of moisture at the sealing edge to a non-drip formation of medium over the back-face of the seal. It is better to accept this "minimum leakage" rather than risking the lip to be damaged due to insufficient lubrication. The permissible leakage in class 1 to 3 is max 1 g to 3 g per seal for a test time of 240 hours.



Radial Oil Seal

Working parameters

Media

The media to be sealed influences heavily the choice of the seal and material type. Mainly liquid media need to be sealed in rotary applications. Pasty media generally restrict the use of rotary seals, especially in terms of circumferential velocity. Gaseous media require specially adapted seal designs.

Liquid media:

Most of the applications relate to lubricating fluids but also hydraulic fluids based on mineral oils acc. DIN 51524 or ISO 6743 or fire resistant hydraulic fluids as well as environmentally friendly hydraulic fluids. In specific application aggressive media with low lubricating capabilities must be sealed. Sealing of other fluids such as water or FDA compliant fluids require in many cases a special sealing solution and will not be covered in detail in this catalogue. For specific needs please contact your local Trelleborg Sealing Solutions marketing company. The media is the first criteria to be considered for the selection of the sealing material type. It will also influence the seal family and the profile.

The evaluation of the compatibility of the seal material with the media to be sealed is based on the analysis of the values of tensile strength, elongation, volume change and hardness change resulting from an immersion test of testing slabs. Please contact your local Trelleborg Sealing Solutions marketing company to select the optimum material for your application.

Mineral oils:

Mainly used in transmissions, elastomer materials have good compatibility with mineral oils within the recommended temperature range. Some mineral oils e.g. hypoid transmission oils contain special additives which produce more demanding operating conditions e.g. temperature range and/or high pressure. For these fields testing is recommended.

Synthetic oils:

For improvement of the viscosity, high temperature and/or service life, new oils with specific additives have been launched as partial or full synthetic oils. Elastomer sealing materials give the same good compatibility to synthetic mineral oils as they do to mineral oils. However, compatibility needs to be checked. .

Grease:

Often used for roller and plain bearings, this media requires special adaptation of the sealing solution. To reduce the risk of tilting the sealing lip and allow the sealing lip to open under increasing pressure, the seal is installed in the reverse direction. Another important parameter to be considered is the maximum circumferential velocity. The maximum speed must be reduced to 50% of the permitted speed in oil, due to the poor heat exchange the grease can provide.

Above this limit the change from grease to oil or installation of seal with PTFE based lip (Turcon® and other) should be considered.

Poor lubricating media:

For those media an initial lubrication of the seal is required to avoid dry running. In such applications we recommend the radial oil seal with dust lip. The area between the lips will be used as a lubricant reservoir. Two seals in tandem Radial oil seal/ Radial oil seal or Radial oil seal/GAMMA seal will provide the same result

Aggressive media:

Generally aggressive media (e.g. solvents) have poor lubricating properties and therefore we recommend Turcon® Varilip® or PDR seals. Turcon® and other PTFE materials solve the problem of chemical resistance and the metal cage can be produced out of various Stainless Steel materials.



Environmentally-friendly hydraulic fluids (bio oils)

When machines or process equipment are hydraulically operated, escaping hydraulic oil can pollute surface waters and the ground. One way of minimizing the danger posed by unwanted leakage, is the use of biologically degradable, non toxic oils. In many countries, there are already statutory regulations and catalogs of requirements for dealing with materials that endanger water. Hydraulic and transmission fluids that protect the environment are already specified in some cases. Figure 12 shows the types of biodegradable fluids.

Environmentally-friendly fluids have application in all systems, which operate for example in mobile and agricultural machinery and in the water and forestry industries. In stationary systems, they are employed in plants where water is at risk, such as locks, water turbines and for foodstuffs and pharmaceutical products.

An important criterion for biologically rapidly degradable fluids is their compatibility with seals. In Table V the resistance of elastomeric materials are given to "bio-oils".

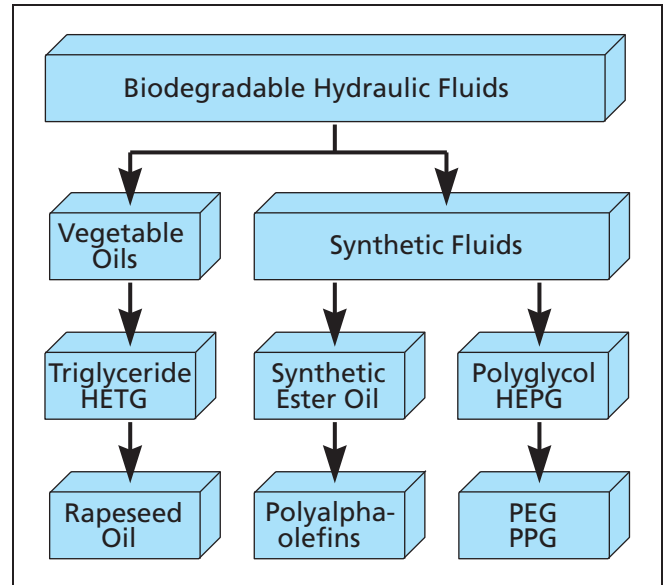


Figure 12 Biodegradable hydraulic fluids

Table V Recommendations for the use of standard elastomer materials and accordance with ISO VG 32 to 68 and VDMA Directive 24569

Oil Temperature	< 60°C	< 80°C	< 100°C	< 120°C
Oil Type / ISO VG	32 - 68	32 - 68	32 - 68	32 - 68
HETG (Rapeseed)	AU ¹	AU ¹	—	—
	NBR	NBR	—	—
	HNBR	HNBR	—	—
	FKM	FKM	—	—
HEES	AU ¹	AU ¹	—	—
	NBR ¹	NBR ¹	—	—
	HNBR ¹	HNBR ¹	—	—
	FKM ¹	FKM	FKM	FKM
HEPG (PAG)	AU ¹			
	NBR ¹	NBR		
	HNBR ¹	HNBR	HNBR	HNBR
	FKM ¹	FKM ²	FKM ²	FKM ²
HEPR (PAO)	not yet specified	not yet specified	not yet specified	not yet specified

1. For dynamic application, specific test required

2. Preferred peroxide cured FKM



Radial Oil Seal

Standard types of rotary seals

Standard elastomeric rotary shaft seals are designed according to DIN 3760 (3761) and ISO 6194/1 recommendations.

Types DIN A and DIN AS may have wavy or flat outer sheath.

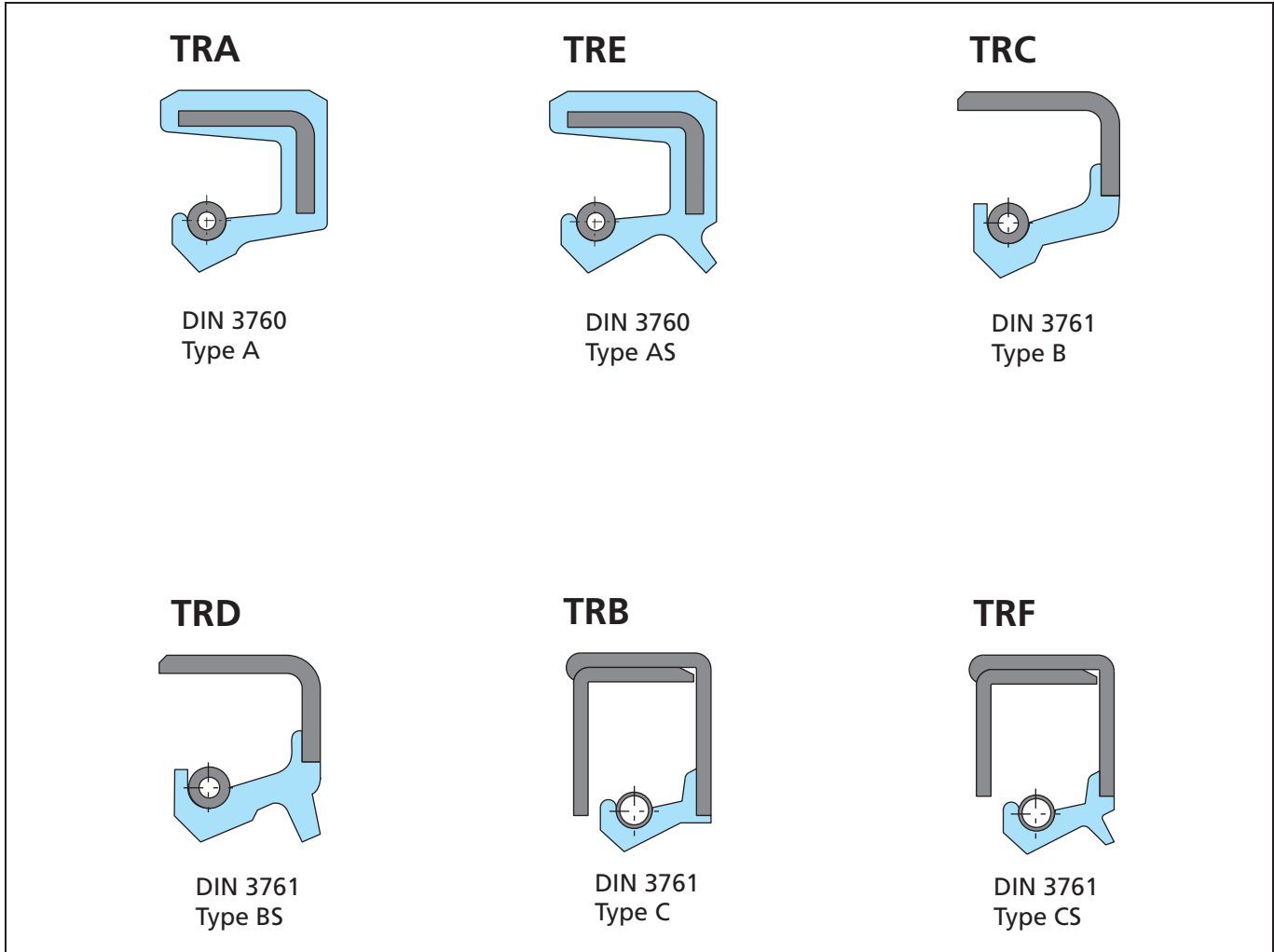


Figure 13 Standard types



■ Trelleborg Sealing Solutions type TRA

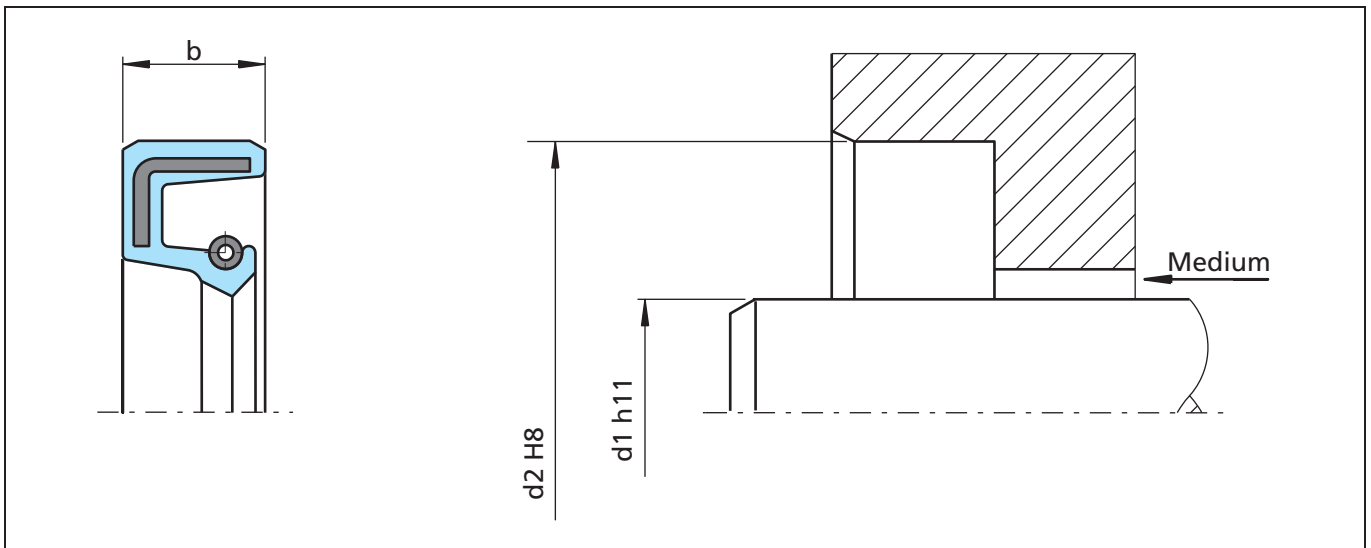


Figure 14 Installation drawing

General description

Trelleborg Sealing Solutions type TRA are seals with completely rubber covered outer diameter. Two different O.D design are available: Flat rubber sheath as well as wavy.

This type is not recommended for use in heavily polluted environments.

Advantages

- Good static sealing
- Compensation of different thermal expansion
- Reduced risk of fretting corrosion
- Higher bore surface roughness is allowed
- Installation in split-housings
- Modern lip design provides low radial forces

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 30m/s (depending on material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table VI Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS Type: A
 Code: TRA
 Dimensions: Shaft diameter 25 mm
 Housing diameter 40 mm
 Width 7 mm
 Material: NBR
 Material Code: N7MM

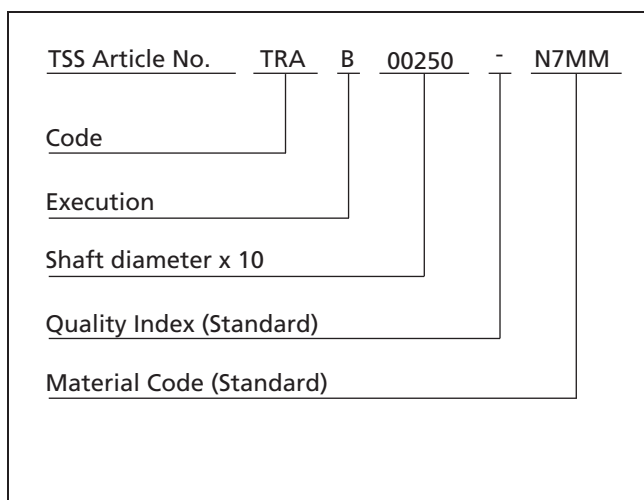


Table VII Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
4	11	5	TRA200040		X
4	12	6	TRA100040	X	X
5	15	6	TRA000050	X	X
6	12	5.5	TRA400060	X	X
6	15	4	TRA000060	X	
6	16	5	TRA100060	X	
6	16	7	TRAA00060	X	X
6	19	7	TRA300060	X	X
6	22	7	TRAB00060	X	X
6	22	8	TRA600060	X	
7	16	7	TRA000070	X	X
7	22	7	TRAA00070	X	X
8	14	4	TRA700080	X	
8	16	5	TRA100080	X	
8	16	7	TRA200080	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
8	18	5	TRA300080	X	
8	22	4	TRA500080	X	
8	22	7	TRAA00080	X	X
8	22	8	TRAF00080		X
8	24	7	TRAB00080	X	X
8.5	18	7	TRA000085	X	
9	22	7	TRAA00090	X	X
9	24	7	TRAB00090	X	
9	26	7	TRAC00090	X	
9	30	7	TRA300090	X	
10	16	4	TRA000100	X	X
10	18	4	TRA200100	X	
10	18	6	TRA300100	X	
10	19	7	TRA400100	X	X
10	22	7	TRAA00100	X	X
10	24	7	TRAB00100	X	
10	25	8	TRA500100	X	
10	26	7	TRAC00100	X	X
10	28	7	TRA600100	X	
11	17	4	TRA000110	X	X
11	19	7	TRA100110	X	
11	22	7	TRAA00110	X	
11	26	7	TRAB00110	X	
11	30	7	TRA200110	X	
11.5	22	5	TRA000115		X
12	19	5	TRA000120	X	X
12	20	4	TRA100120	X	
12	20	5	TRA200120	X	
12	22	4	TRAF00120	X	X
12	22	7	TRAA00120	X	X
12	24	7	TRAB00120	X	X
12	25	5	TRA600120	X	
12	25	8	TRA700120	X	X
12	26	7	TRA800120	X	
12	26	8	TRAJ00120	X	
12	28	7	TRAC00120	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
12	30	7	TRAD00120	X	X
12	30	10	TRA300120	X	
12	32	7	TRAH00120	X	X
12	32	10	TRAI00120	X	
12	37	10	TRAK00120	X	
12	45	7	TRAL00120	X	
13	25	5	TRA100130	X	
13	26	7	TRA200130	X	X
13	30	8	TRA300130	X	
14	22	4	TRA000140	X	X
14	22	7	TRA400140	X	X
14	24	7	TRAA00140	X	X
14	25	5	TRA100140	X	
14	28	7	TRAB00140	X	
14	28.55	6.3	TRAF00140		X
14	30	7	TRAC00140	X	X
14	35	7	TRAD00140	X	
14.5	28.55	6.3	TRA000145		X
15	22	7	TRA000150	X	
15	24	5	TRAF00150	X	
15	24	7	TRA200150	X	X
15	25	5	TRA300150	X	X
15	26	6	TRA400150	X	
15	26	7	TRAA00150	X	X
15	28	5	TRA500150		X
15	28	7	TRA600150	X	X
15	30	7	TRAB00150	X	X
15	30	10	TRA700150	X	X
15	32	7	TRAC00150	X	X
15	35	7	TRAD00150	X	X
15	35	10	TRAJ00150	X	X
15	40	7	TRAN00150	X	
15	40	10	TRA100150	X	
15	42	7	TRAG00150	X	
15	42	10	TRAH00150	X	X
16	22	4	TRA000160	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
16	24	4	TRA500160	X	
16	24	5	TRA200160	X	X
16	24	7	TRA300160	X	
16	26	7	TRA400160	X	
16	28	7	TRAA00160	X	X
16	30	7	TRAB00160	X	X
16	30	10	TRAF00160	X	X
16	32	7	TRAC00160	X	
16	35	7	TRAD00160	X	
16	35	10	TRA600160	X	X
17	25	4	TRA100170	X	
17	26	6	TRA300170	X	
17	28	5	TRA400170	X	X
17	28	6	TRA900170	X	
17	28	7	TRAA00170	X	X
17	30	7	TRAB00170	X	
17	32	7	TRAC00170	X	X
17	32	10	TRAP00170		X
17	35	5	TRAL00170	X	
17	35	7	TRAD00170	X	X
17	35	8	TRA700170	X	
17	40	7	TRAE00170	X	X
17	40	10	TRAF00170	X	
17	47	7	TRAG00170	X	X
17	47	10	TRAH00170	X	
18	24	4	TRA500180		X
18	28	7	TRA100180	X	X
18	30	7	TRAA00180	X	X
18	32	7	TRAB00180	X	X
18	32	8	TRA200180	X	X
18	35	7	TRAC00180	X	X
18	35	10	TRA300180	X	
18	40	7	TRAD00180	X	X
18	40	10	TRA400180	X	
19	32	7	TRA200190	X	
19	35	7	TRA300190	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
19	35	10	TRA500190	X	X
19	40	10	TRA900190	X	
20	28	6	TRA100200	X	X
20	28	7	TRA300200	X	
20	30	5	TRA200200	X	X
20	30	7	TRAA00200	X	X
20	30	8	TRAJ00200		X
20	32	7	TRAB00200	X	X
20	35	5	TRA500200	X	
20	35	6	TRA600200	X	
20	35	6.2	TRAR00200	X	
20	35	7	TRAC00200	X	X
20	35	10	TRA800200	X	X
20	37	7	TRAM00200	X	
20	37	8	TRA900200	X	
20	38	7	TRAP00200	X	
20	40	7	TRAD00200	X	X
20	40	10	TRAF00200	X	
20	42	7	TRAG00200	X	X
20	42	10	TRAH00200	X	
20	47	6	TRAS00200		X
20	47	7	TRAE00200	X	X
20	47	9.5	TRAT00200		X
20	47	10	TRAI00200	X	
20	52	7	TRA400200	X	
20	52	10	TRAK00200	X	
22	30	7	TRAK00220		X
22	32	4	TRAE00220	X	
22	32	7	TRAA00220	X	X
22	35	5	TRA200220	X	
22	35	6	TRAF00220	X	
22	35	7	TRAB00220	X	X
22	35	8	TRA000220	X	
22	35	10	TRA100220	X	X
22	37	7	TRA300220	X	
22	38	7	TRAI00220	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
22	38	8	TRA500220	X	
22	40	7	TRAC00220	X	X
22	40	10	TRA700220	X	
22	42	7	TRA800220	X	
22	42	10	TRA900220	X	
22	45	7	TRAH00220	X	
22	47	7	TRAD00220	X	X
22	47	10	TRAG00220	X	
22.5	53	10	TRA000225	X	X
23	40	10	TRA100230	X	
23	42	5	TRA500230	X	X
23	42	10	TRA200230	X	
24	35	7	TRAA00240	X	X
24	37	7	TRAB00240	X	
24	40	7	TRAC00240	X	X
24	42	8	TRA900240	X	
24	42	10	TRA600240	X	
24	47	7	TRAD00240	X	X
24	47	10	TRA300240	X	
25	32	6	TRA000250	X	
25	33	6	TRA300250	X	X
25	35	5	TRA400250	X	
25	35	7	TRAA00250	X	X
25	36	6	TRA500250	X	
25	37	5	TRAW00250	X	
25	37	7	TRA700250	X	X
25	38	7	TRA800250	X	X
25	40	5	TRA900250	X	
25	40	7	TRAB00250	X	X
25	40	8	TRAF00250	X	
25	40	10	TRAG00250	X	X
25	42	6	TRAMGA001	X	
25	42	7	TRAC00250	X	X
25	42	10	TRAH00250	X	X
25	43	10	TRAU00250		X
25	45	7	TRAI00250	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
25	45	10	TRAJ00250	X	X
25	46	7	TRAX00250	X	
25	47	7	TRAD00250	X	X
25	47	8	TRAK00250	X	X
25	47	10	TRAL00250	X	X
25	50	10	TRAM00250	X	X
25	52	7	TRAE00250	X	X
25	52	8	TRAN00250	X	
25	52	10	TRAO00250	X	
25	62	7	TRAQ00250	X	
25	62	8	TRA200250	X	
25	62	10	TRAR00250	X	X
26	34	4	TRA100260		X
26	37	7	TRAA00260	X	X
26	42	7	TRAB00260	X	
26	47	7	TRAC00260	X	
26	47	10	TRA300260		X
27	37	7	TRA300270	X	X
27	42	10	TRA600270	X	X
27	47	10	TRA800270	X	
27	50	8	TRA100270	X	
28	38	7	TRA000280	X	X
28	40	7	TRAA00280	X	X
28	42	7	TRA400280	X	
28	42	8	TRA200280	X	
28	42	10	TRA800280	X	X
28	42.5	8	TRAJ00280	X	X
28	43	10	TRA900280	X	X
28	45	8	TRAI00280	X	X
28	47	7	TRAB00280	X	X
28	47	10	TRA500280	X	
28	48	10	TRAG00280	X	
28	50	10	TRA600280		X
28	52	7	TRAC00280	X	X
28	52	10	TRA700280	X	
29	50	10	TRA300290	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d₁	d₂	b		NBR	FKM
30	40	7	TRAA00300	X	X
30	40	8	TRAY00300	X	
30	40	10	TRAMGA002	X	
30	41	8	TRAMGA003	X	
30	42	5	TRAMGA004	X	
30	42	5.7	TRAV00300	X	
30	42	7	TRAB00300	X	X
30	44	10	TRA000300	X	
30	45	7	TRA400300	X	X
30	45	8	TRA500300	X	
30	45	10	TRA700300	X	
30	47	4	TRA800300	X	
30	47	7	TRAC00300	X	X
30	47	8	TRA900300	X	
30	47	10	TRAF00300	X	
30	48	8	TRAG00300	X	X
30	50	7	TRAI00300	X	
30	50	8	TRAH00300	X	
30	50	10	TRAJ00300	X	X
30	52	7	TRAD00300	X	X
30	52	8	TRAMGA005	X	
30	52	8.5	TRAMGA006	X	
30	52	10	TRAM00300	X	X
30	55	7	TRAN00300	X	X
30	55	10	TRAO00300	X	X
30	56	10	TRAMGA007	X	X
30	60	10	TRAQ00300	X	
30	62	7	TRAE00300	X	X
30	62	10	TRAR00300	X	X
30	62	12	TRAS00300	X	
30	72	8	TRAT00300	X	
30	72	10	TRAU00300	X	X
31	42	8	TRA200310	X	X
31	47	7	TRA000310	X	
32	40	7	TRAG00320	X	X
32	40	8	TRA000320	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
32	42	7	TRA300320	X	X
32	45	7	TRAA00320	X	X
32	47	7	TRAB00320	X	X
32	50	8	TRA400320	X	X
32	50	10	TRA600320	X	X
32	52	6	TRAJ00320	X	
32	52	7	TRAC00320	X	X
32	52	10	TRA800320	X	X
32	54	8	TRA900320		X
32	55	10	TRA700320	X	
32	56	10	TRAH00320	X	
32	62	10	TRAI00320	X	
33	45	7	TRA000330	X	
34	50	10	TRA200340	X	X
34	52	8	TRA300340	X	X
34	52	10	TRA100340	X	
34	62	10	TRA600340	X	
35	45	7	TRA000350	X	X
35	47	4.5	TRAT00350	X	
35	47	7	TRAA00350	X	X
35	47	10	TRAMGA008	X	
35	48	9	TRAMGA009	X	
35	50	7	TRAB00350	X	X
35	50	8	TRA200350	X	
35	50	10	TRA300350	X	X
35	52	7	TRAC00350	X	X
35	52	8	TRA400350	X	
35	52	8.5	TRAMGA010	X	
35	52	10	TRA500350	X	X
35	54	10	TRAV00350	X	
35	55	8	TRA600350	X	X
35	55	10	TRA700350	X	X
35	56	10	TRA900350	X	X
35	58	10	TRAG00350	X	
35	60	10	TRAH00350	X	X
35	62	7	TRAD00350	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
35	62	8	TRAI00350	X	
35	62	10	TRAJ00350	X	
35	62	12	TRAK00350	X	
35	65	10	TRAL00350	X	
35	68	10	TRAW00350	X	X
35	68	12	TRAU00350	X	
35	72	7	TRAM00350	X	
35	72	10	TRAN00350	X	X
35	72	12	TRAO00350	X	
35	80	10	TRAQ00350	X	
35	80	13	TRAS00350	X	
36	47	7	TRAA00360	X	
36	50	7	TRAB00360	X	X
36	52	7	TRAC00360	X	X
36	56	10	TRA200360	X	
36	58	12	TRA500360	X	
36	62	7	TRAD00360	X	
36	68	10	TRA400360	X	
37	47.5	5	TRA500370		X
37	52	8	TRA600370	X	
37	52	10	TRA700370	X	
37	80	12	TRA400370	X	
38	50	7	TRA000380	X	
38	52	7	TRAA00380	X	X
38	52	8	TRAF00380	X	
38	52	10	TRAL00380	X	
38	54	6.5	TRA900380	X	X
38	54	10	TRA200380	X	
38	55	7	TRAB00380	X	X
38	55	10	TRA300380	X	
38	56	10	TRAG00380	X	
38	60	10	TRAJ00380	X	
38	62	7	TRAC00380	X	X
38	62	10	TRA500380	X	X
38	65	8	TRAI00380	X	
38	68	8	TRAM00380		X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
38	70	10	TRAN00380	X	
38	72	10	TRA700380	X	
40	50	8	TRA000400	X	X
40	52	6	TRA100400	X	
40	52	7	TRAA00400	X	X
40	52	8	TRA200400	X	
40	52	10	TRA300400	X	
40	55	7	TRAB00400	X	X
40	55	8	TRA400400	X	
40	55	10	TRA500400	X	
40	56	8	TRA700400	X	
40	56	10	TRAL00400	X	
40	58	8	TRAMGA011	X	
40	58	9	TRA900400	X	
40	58	10	TRAF00400	X	X
40	58	12	TRAMGA012	X	
40	60	10	TRAH00400	X	X
40	62	7	TRAC00400	X	X
40	62	10	TRAI00400	X	X
40	62	11.5	TRAMGA013	X	
40	62	12	TRAJ00400	X	
40	65	10	TRAK00400	X	X
40	68	7	TRAM00400	X	
40	68	10	TRAN00400	X	X
40	68	12	TRAMGA014	X	
40	72	7	TRAD00400	X	X
40	72	10	TRAQ00400	X	X
40	80	7	TRAS00400	X	
40	80	8	TRAMGA015	X	
40	80	10	TRAT00400	X	X
40	85	10	TRAU00400	X	
40	90	8	TRAV00400	X	
40	90	12	TRAW00400	X	
42	55	7	TRA000420	X	
42	55	8	TRAA00420	X	X
42	56	7	TRA100420	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
42	58	10	TRA900420	X	
42	60	10	TRA200420	X	
42	62	7	TRA300420	X	X
42	62	8	TRAB00420	X	X
42	62	10	TRA400420	X	
42	65	10	TRA500420	X	
42	68	10	TRAI00420	X	
42	72	7	TRA700420	X	X
42	72	8	TRAC00420	X	X
42	72	10	TRA800420	X	
42	80	10	TRAH00420	X	
44	60	10	TRA000440	X	
44	62	10	TRA100440	X	
44	65	10	TRA200440	X	
44	70	12	TRA500440	X	
44	72	10	TRA600440	X	X
44.5	62	10	TRA000445	X	
45	52	7	TRA000450	X	
45	55	7	TRA200450	X	
45	58	7	TRA300450	X	
45	60	7	TRA400450	X	X
45	60	8	TRAA00450	X	X
45	60	10	TRA500450	X	X
45	62	7	TRA600450	X	X
45	62	8	TRAB00450	X	X
45	62	10	TRA800450	X	X
45	62	12	TRA900450	X	
45	65	8	TRAC00450	X	X
45	65	10	TRAF00450	X	
45	68	10	TRAH00450	X	
45	68	12	TRAI00450	X	
45	70	10	TRAJ00450	X	
45	72	7	TRAU00450	X	
45	72	8	TRAD00450	X	X
45	72	10	TRAK00450	X	
45	75	7	TRAL00450	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
45	75	8	TRAM00450	X	
45	75	10	TRAN00450	X	X
45	80	8	TRAO00450	X	
45	80	10	TRAP00450	X	X
45	85	10	TRAR00450	X	X
47	62	6	TRA000470	X	
48	62	8	TRAA00480	X	X
48	62	10	TRA500480	X	
48	65	10	TRA000480	X	
48	68	10	TRA100480	X	X
48	72	8	TRAB00480	X	X
48	72	10	TRA400480	X	X
48	80	10	TRA600480	X	
48	90	10	TRA900480	X	X
50	60	10	TRAM00500	X	
50	62	7	TRA000500	X	X
50	62	10	TRA100500	X	
50	65	8	TRAA00500	X	X
50	65	10	TRA200500	X	X
50	68	8	TRAB00500	X	X
50	68	10	TRA300500	X	X
50	70	8	TRA500500	X	
50	70	10	TRA600500	X	X
50	70	12	TRA700500	X	X
50	72	6	TRA800500	X	
50	72	8	TRAC00500	X	X
50	72	10	TRA900500	X	X
50	74	10	TRAP00500	X	
50	75	10	TRAG00500	X	X
50	80	8	TRAD00500	X	X
50	80	10	TRAH00500	X	X
50	80	13	TRAQ00500	X	
50	85	10	TRAI00500	X	
50	90	10	TRAK00500	X	X
50	100	10	TRAN00500	X	
51	72	10	TRA000510	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
52	65	8	TRA800520	X	
52	68	8	TRAA00520	X	X
52	68	10	TRA000520	X	
52	69	10	TRA500520	X	
52	72	8	TRAB00520	X	X
52	72	10	TRA100520	X	
52	75	12	TRA300520	X	X
52	76.2	10	TRA900520	X	
52	80	10	TRA400520	X	
52	85	10	TRA700520	X	
53	68	10	TRA000530	X	
54	70	10	TRA000540	X	
54	85	10	TRA500540	X	
54	90	13	TRA200540	X	
55	68	8	TRA000550	X	X
55	68	10	TRAM00550	X	
55	70	8	TRAA00550	X	X
55	70	10	TRA100550	X	
55	72	8	TRAB00550	X	X
55	72	10	TRA200550	X	X
55	75	8	TRA300550	X	
55	75	10	TRA400550	X	X
55	75	12	TRAN00550	X	
55	78	10	TRAI00550	X	
55	80	7	TRAL00550	X	X
55	80	8	TRAC00550	X	X
55	80	10	TRA600550	X	X
55	80	12	TRA700550	X	
55	80	13	TRA800550	X	
55	85	8	TRAD00550	X	X
55	85	10	TRA900550	X	X
55	90	10	TRAG00550	X	X
55	100	10	TRAH00550	X	X
55	100	12	TRAK00550	X	
56	70	8	TRAA00560	X	
56	72	8	TRAB00560	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
56	72	9	TRA000560	X	
56	80	8	TRAC00560	X	
56	85	8	TRAD00560	X	
58	72	8	TRAA00580	X	X
58	80	8	TRAB00580	X	X
58	80	10	TRA200580	X	X
58	85	10	TRA300580	X	
58	90	10	TRA100580	X	
60	70	7	TRA000600	X	
60	72	8	TRA100600	X	X
60	75	8	TRAA00600	X	X
60	78	10	TRA300600	X	X
60	80	8	TRAB00600	X	X
60	80	10	TRA500600	X	X
60	80	13	TRA600600	X	
60	85	8	TRAC00600	X	X
60	85	10	TRA800600	X	X
60	85	13	TRA900600	X	
60	90	8	TRAD00600	X	
60	90	10	TRAF00600	X	X
60	90	13	TRAG00600	X	
60	95	10	TRAH00600	X	X
60	100	10	TRAI00600	X	
60	110	12	TRAN00600	X	
60	110	13	TRAJ00600		X
62	75	10	TRA000620	X	
62	80	9	TRA100620	X	
62	80	10	TRA200620	X	X
62	85	10	TRAA00620	X	X
62	90	10	TRAB00620	X	X
62	95	10	TRA300620	X	
62	100	12	TRA500620	X	
63	85	10	TRAA00630	X	
63	90	10	TRAB00630	X	
63.5	90	13	TRA000635	X	
64	77	8	TRA400640		X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
64	80	8	TRA000640	X	X
64	85	10	TRA300640	X	
65	80	8	TRA000650	X	X
65	80	10	TRA100650	X	
65	85	8	TRA200650	X	
65	85	10	TRAA00650	X	X
65	85	12	TRA300650	X	
65	90	10	TRAB00650	X	X
65	90	12	TRA400650	X	
65	90	13	TRA500650	X	
65	95	10	TRA600650	X	
65	100	10	TRAC00650	X	X
65	100	12	TRA800650	X	
65	110	10	TRA900650	X	
65	120	10	TRAF00650	X	
65	120	12	TRA700650	X	
68	85	10	TRA000680	X	
68	90	10	TRAA00680	X	X
68	100	10	TRAB00680	X	X
70	85	7	TRA000700	X	
70	85	8	TRA100700	X	X
70	90	10	TRAA00700	X	X
70	90	13	TRA300700	X	X
70	95	10	TRA400700	X	
70	95	13	TRA500700	X	X
70	100	10	TRAB00700	X	X
70	100	12	TRA600700	X	
70	105	13	TRAN00700	X	
70	110	8	TRA900700	X	
70	110	12	TRAG00700	X	X
72	90	10	TRA000720	X	
72	95	10	TRAA00720	X	X
72	100	10	TRAB00720	X	X
75	90	8	TRA000750	X	X
75	90	10	TRA100750	X	
75	95	10	TRAA00750	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
75	95	12	TRA200750	X	X
75	100	10	TRAB00750	X	X
75	100	12	TRA400750	X	X
75	105	12	TRAH00750	X	
75	105	13	TRAI00750	X	X
75	110	10	TRA600750	X	
75	110	12	TRA700750	X	X
75	115	10	TRA500750	X	
78	100	10	TRAA00780	X	X
78	110	12	TRA000780		X
80	95	8	TRA000800	X	X
80	100	10	TRAA00800	X	X
80	100	12	TRAF00800	X	
80	100	13	TRA100800	X	
80	105	10	TRA200800	X	X
80	105	13	TRA300800	X	
80	110	10	TRAB00800	X	X
80	110	12	TRA400800	X	X
80	110	13	TRA500800	X	X
80	115	10	TRA600800	X	
80	115	13	TRAK00800	X	
80	120	13	TRA900800	X	X
80	125	13	TRA800800	X	
80	140	13	TRAJ00800	X	
80	150.5	13	TRAL00800	X	X
82	105	12	TRA100820	X	
82	110	12	TRA200820	X	
85	100	9	TRA300850	X	X
85	105	10	TRA000850	X	
85	105	13	TRA900850	X	X
85	110	10	TRA100850	X	X
85	110	12	TRAA00850	X	X
85	110	13	TRA200850	X	X
85	115	13	TRA400850	X	
85	120	12	TRAB00850	X	X
85	130	12	TRAI00850	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
85	130	13	TRA800850	X	
88	110	12	TRA000880	X	X
90	110	8	TRA100900	X	
90	110	10	TRA200900	X	X
90	110	12	TRAA00900	X	X
90	110	13	TRA300900	X	
90	115	12	TRAF00900		X
90	115	13	TRA500900	X	
90	120	10	TRA600900	X	
90	120	12	TRAB00900	X	X
90	120	13	TRA700900	X	
90	130	12	TRA000900	X	
90	140	13	TRA900900	X	
92	120	13	TRA000920	X	X
95	110	6	TRA000950		X
95	110	10	TRA800950	X	X
95	110	12	TRA500950	X	X
95	115	12	TRA600950	X	X
95	115	13	TRA100950	X	
95	120	12	TRAA00950	X	X
95	120	13	TRA200950	X	
95	125	12	TRAB00950	X	X
95	130	12	TRA400950	X	
95	136	13	TRA900950	X	X
95	145	13	TRA700950	X	
95	150.5	13	TRAF00950	X	
95	180.5	13	TRAG00950	X	X
96	117	10	TRA000960		X
98	120	13	TRA000980	X	X
100	115	9	TRAG01000	X	
100	120	10	TRA001000	X	
100	120	12	TRAA01000	X	X
100	120	13	TRA101000	X	
100	125	12	TRAB01000	X	X
100	125	13	TRA201000	X	
100	130	10	TRA301000	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
100	130	12	TRAC01000	X	X
100	130	13	TRA701000	X	
100	140	13	TRA50100	X	
100	150	12	TRA601000	X	
100	185	13	TRAI01000	X	
102	130	13	TRA001020	X	X
105	125	10	TRA001050	X	
105	125	13	TRA101050	X	
105	130	12	TRAA01050	X	X
105	130	13	TRA301050	X	
105	140	12	TRAB01050	X	X
105	150	15	TRA401050		X
110	130	8	TRA101100	X	
110	130	12	TRAA01100	X	X
110	130	13	TRA201100	X	
110	140	12	TRAB01100	X	X
110	140	13	TRA401100	X	
110	150	13	TRA801100	X	
110	150	15	TRA601100	X	
110	180.5	13	TRA301100	X	
110	200	13	TRA701100	X	
115	130	12	TRA001150		X
115	135	10	TRA101150	X	
115	140	12	TRAA01150	X	X
115	140	13	TRA201150	X	
115	150	10	TRA301150		X
115	150	12	TRAB01150	X	X
120	140	12	TRA101200	X	
120	140	13	TRA201200	X	X
120	145	15	TRAF01200	X	
120	150	12	TRAA01200	X	X
120	150	13	TRA401200	X	
120	160	12	TRAB01200	X	X
122	150	15	TRA001220	X	X
125	150	12	TRAA01250	X	X
125	150	13	TRA001250	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
125	160	12	TRAB01250	X	X
128	150	15	TRA001280	X	
130	150	10	TRA001300	X	X
130	150	10.8	TRA6001300	X	
130	160	7.5	TRA5011300	X	
130	160	12	TRAA01300	X	X
130	160	13	TRA101300	X	
130	160	15	TRA301300	X	
130	170	12	TRAB01300	X	X
130	170	13	TRA201300		X
130	180	15	TRA401300	X	
135	160	12	TRA001350	X	X
135	160	13	TRA101350	X	
135	160	15	TRA301350	X	
135	170	12	TRAA01350	X	X
140	160	12	TRA201400	X	
140	160	13	TRA001400	X	X
140	165	12	TRA101400	X	X
140	170	12	TRA301400	X	X
140	170	13	TRA401400	X	
140	170	15	TRAA01400	X	X
140	180	12	TRA801400	X	X
140	190	15	TRA901400	X	
145	170	15	TRA401450	X	
145	175	15	TRAA01450	X	X
145	180	12	TRA301450	X	
148	170	15	TRA001480	X	X
150	170	15	TRA101500		X
150	180	12	TRA201500	X	X
150	180	13	TRA301500	X	
150	180	15	TRAA01500	X	X
155	174	12	TRA001550	X	
155	180	15	TRA101550	X	
155	190	15	TRA201550	X	
160	180	10	TRA501600	X	
160	180	15	TRA001600	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
160	185	10	TRA101600	X	
160	185	13	TRA601600		X
160	190	13	TRA201600	X	
160	190	15	TRAA01600	X	X
160	200	12	TRA401600	X	X
165	190	13	TRA001650	X	X
170	190	10	TRA301700	X	
170	200	12	TRA201700	X	X
170	200	15	TRAA01700	X	X
175	200	10	TRA001750		X
175	200	15	TRA101750	X	X
175	205	15	TRAR01750	X	X
180	200	15	TRA001800	X	
180	210	15	TRAA01800	X	X
180	215	16	TRA101800	X	
180	220	15	TRA201800	X	
185	210	10	TRA001850		X
185	210	13	TRA101850	X	X
190	215	15	TRA601900		X
190	220	15	TRAA01900	X	X
190	225	16	TRA101900	X	
195	230	16	TRA001950	X	
200	225	15	TRA202000	X	
200	230	15	TRAA02000	X	X
200	250	15	TRA002000	X	
205	230	16	TRA102050		X
210	240	15	TRAA02100	X	X
210	250	15	TRA002100	X	
215	240	12	TRA002150	X	
220	250	15	TRAA02200	X	X
220	260	16	TRA102200	X	
230	260	15	TRAA02300	X	X
230	270	15	TRA002300	X	
240	270	15	TRAA02400	X	X
240	280	15	TRA002400	X	
240	335	15	TRA202400	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
250	280	15	TRAA02500	X	X
250	290	15	TRA002500	X	
260	290	15	TRA102600	X	
260	300	20	TRAA02600	X	X
265	290	16	TRA002650	X	X
265	310	16	TRA102650	X	
280	310	15	TRA202800		X
280	320	20	TRAA02800	X	
300	340	16	TRA003000	X	
300	340	18	TRA103000	X	
300	340	20	TRAA03000	X	
320	360	20	TRAA03200	X	
340	380	20	TRAA03400	X	
360	400	18	TRA003600		X
360	400	20	TRAA03600	X	
380	420	20	TRAA03800	X	X
400	440	20	TRAA04000	X	
420	450	15	TRA004200	X	
420	460	20	TRAA04200	X	
440	480	20	TRAA04400	X	X
480	520	20	TRAA04800	X	
500	540	20	TRAA05000	X	
800	840	20	TRA008000	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



■ Trelleborg Sealing Solutions type TRE

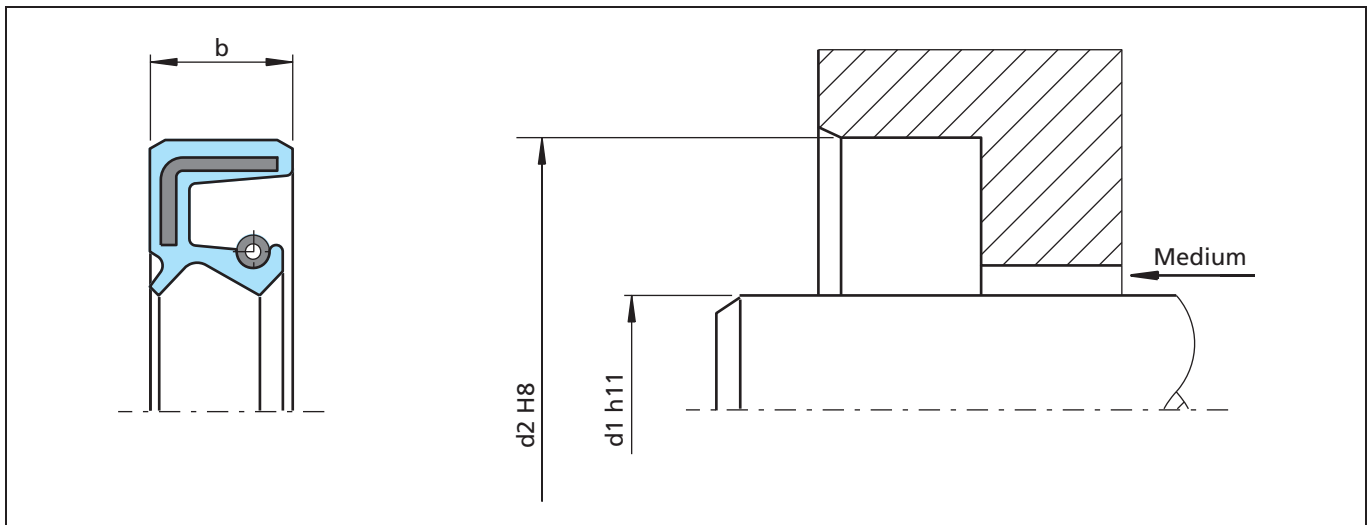


Figure 15 Installation drawing

General description

Trelleborg Sealing Solutions type TRE are seals with completely rubber covered outer diameter. Two different O.D. design are available: Flat rubber sheath as well as wavy. The additional dust lip protects the main sealing lip against dust and other fine solid contaminants and therefore this type is recommended for use in polluted environments. To achieve a long lifetime a suitable lubricant between the two sealing lips should be applied.

Advantages

- Good static sealing
- Compensation of different thermal expansion
- Reduced risk of fretting corrosion
- Effective protection against air side contaminants
- Higher bore surface roughness is allowed
- Installation in split-housings
- Modern lip design provides low radial forces

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 30 m/s (depending on material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Table VIII Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: E
 Code: TRE
 Dimensions: Shaft diameter 15 mm
 Housing diameter 30 mm
 Width 7 mm
 Material: NBR
 Material Code: N7MM

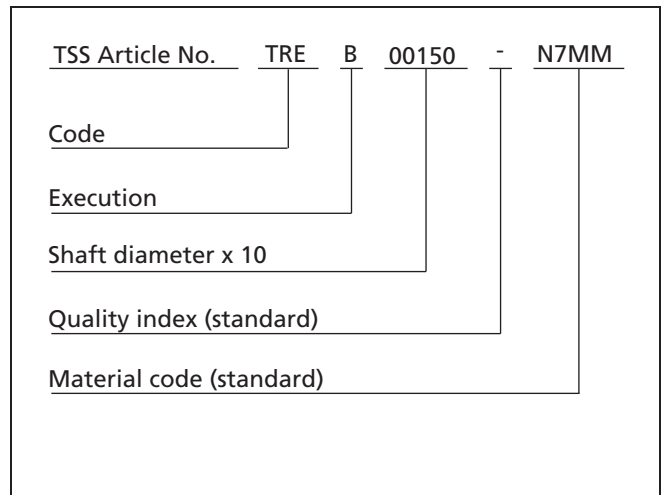


Table IX Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
8	16	7	TRE000080	X	
10	18	6	TRE100100	X	
10	19	7	TRE200100	X	
10	20	5	TRE300100	X	
10	22	7	TREA00100	X	X
10	26	7	TREC00100	X	
11	17	4	TRE000110	X	
12	19	5	TRE000120	X	
12	20	5	TRE400120	X	
12	22	6	TRE200120	X	
12	22	7	TREA00120	X	X
12	25	7	TREE00120	X	
12	28	7	TREC00120	X	X
12	32	7	TRE300120	X	
13	26	9	TRE100130		X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
14	35	7	TRED00140		X
15	24	7	TRE000150	X	X
15	26	7	TREA00150	X	X
15	28	7	TRE100150	X	
15	30	7	TREB00150	X	X
15	32	7	TREC00150	X	X
15	35	7	TRED00150	X	X
16	28	7	TREA00160	X	X
16	29	4	TRE400160	X	
17	28	7	TREA00170	X	
17	30	7	TREB00170	X	
17	37	7	TRE400170		
17	40	7	TREE00170	X	
17.8	26.2	3.5	TRE000178		X
18	28	7	TRE000180	X	
18	30	7	TREA00180	X	
18	32	7	TREB00180	X	
18	35	7	TREC00180	X	
20	30	7	TREA00200	X	X
20	34	7	TRE100200	X	
20	35	7	TREC00200	X	X
20	36	7	TRE200200	X	
20	40	7	TRED00200	X	X
20	42	7	TRE300200	X	X
20	42	10	TREJ00200	X	
20	47	7	TREE00200	X	X
20	47	10	TREH00200	X	
20	52	8	TREG00200	X	X
22	28	4	TRE700220	X	
22	32	7	TREA00220	X	X
22	35	7	TREB00220	X	
22	40	7	TREC00220	X	X
22	47	7	TRED00220	X	
24	32	7	TRE000240	X	
24	36	7	TRE100240	X	X
24	47	7	TRED00240	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
25	32	6	TRE00250		X
25	35	6	TRE00250	X	
25	35	7	TREA00250	X	X
25	38	8	TREK00250	X	
25	40	7	TREB00250	X	
25	40	8	TRE100250	X	
25	42	7	TREC00250	X	
25	42	10	TRE300250	X	X
25	47	7	TRED00250	X	X
25	47	8	TRE600250	X	
25	47	10	TRE700250	X	
25	52	7	TREE00250	X	X
25	52	10	TRE900250	X	
25	62	7	TREG00250	X	X
26	37	7	TREA00260	X	
28	40	7	TREA00280	X	X
28	42	8	TRE200280	X	
28	45	7	TREE00280		X
28	47	7	TREB00280	X	X
28	47	10	TRE400280	X	X
28	52	7	TREC00280	X	X
28	52	10	TRE500280	X	
30	40	7	TREA00300	X	X
30	42	5.7	TREQ00300	X	
30	42	6	TRE000300	X	
30	42	7	TREB00300	X	X
30	42	8	TRE100300	X	
30	47	7	TREC00300	X	X
30	47	8	TREK00300	X	X
30	48	7	TREL00300	X	
30	50	10	TRE600300	X	
30	52	7	TRED00300	X	
30	52	10	TRE700300	X	X
30	55	7	TRE800300	X	X
30	55	10	TRE900300	X	X
30	62	7	TREE00300	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
30	62	10	TREF00300	X	
30	72	10	TREG00300	X	
32	42	5	TRE300320	X	
32	45	7	TREA00320	X	
32	45	8	TRE600320	X	
32	47	10	TRE400320	X	
32	50	10	TRE100320	X	
32	52	7	TREC00320	X	X
33	50	6	TRE000330	X	
34	72	10	TRE100340		X
35	47	7	TREA00350	X	X
35	50	7	TREB00350	X	
35	52	6	TRE100350	X	
35	52	7	TREC00350	X	X
35	52	8	TREF00350	X	
35	52	10	TRE200350	X	X
35	55	8	TREK00350	X	
35	56	10	TRE300350	X	
35	58	10	TREG00350	X	
35	62	7	TRED00350	X	
35	62	8	TREU00350	X	
35	62	10	TRE400350	X	X
35	62	12	TRE500350	X	X
35	72	7	TREH00350	X	
35	72	10	TRE700350	X	
35	72	12	TRE800350	X	X
35	80	10	TRE900350	X	
35	80	12	TREQ00350	X	
36	47	7	TREA00360	X	
36	50	7	TREB00360	X	
36	52	7	TREC00360		X
36	54	7	TRE100360	X	
36	58	10	TRE400360	X	
36	68	10	TRE000360	X	
38	52	7	TREA00380	X	X
38	62	10	TRE500380		X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
40	52	5	TREO00400	X	
40	52	7	TREA00400	X	X
40	55	7	TREB00400	X	
40	55	8	TRE100400	X	X
40	56	8	TREG00400	X	
40	58	9	TREQ00400	X	
40	58	10	TREI00400	X	
40	60	10	TRE400400	X	X
40	62	7	TREC00400	X	X
40	62	9	TREZ00400	X	
40	62	10	TRE600400	X	X
40	68	7	TRE700400	X	
40	68	8	TREY00400	X	
40	72	7	TRED00400	X	X
40	72	10	TRE800400	X	X
40	80	7	TRE900400	X	
40	80	8	TREMGE001	X	
40	80	10	TREF00400	X	X
40	80	12	TREMGE002	X	
40	90	8	TREL00400	X	
40	90	10	TREN00400	X	
42	55	8	TREA00420	X	
42	60	7	TRE700420	X	
42	62	7	TRE300420	X	
42	62	10	TRE800420		X
42	72	8	TREC00420	X	
42	72	10	TRE600420		X
45	60	7	TRE000450	X	
45	60	8	TREA00450	X	X
45	62	7	TRE100450	X	
45	62	8	TREB00450	X	X
45	62	10	TRE200450	X	
45	65	8	TREC00450	X	X
45	65	10	TRE300450	X	
45	68	8	TRE400450	X	
45	68	10	TRE500450	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
45	72	8	TRED00450	X	
45	72	10	TRE600450	X	
45	72	12	TRE700450	X	
45	75	7	TRE800450	X	
45	75	8	TREI00450	X	X
45	75	10	TRE900450	X	X
45	80	10	TREF00450	X	
45	85	10	TREG00450	X	X
45	90	10	TREH00450	X	
47	90	10	TRE0P0470		
48	62	8	TREA00480	X	X
48	65	10	TRE000480		X
48	68	10	TRE100480	X	X
48	72	7	TRE200480	X	
48	72	8	TREB00480		X
48	72	12	TRE300480	X	
48	72.5	10	TRE500480	X	
50	62	7	TRE200500	X	
50	65	8	TREA00500	X	X
50	65	10	TREIP0500	X	
50	68	7	TREK00500	X	
50	68	8	TREB00500	X	X
50	68	10	TRE000500	X	
50	70	10	TRE100500	X	
50	72	7	TREF00500	X	X
50	72	8	TREC00500	X	X
50	72	10	TRE300500	X	
50	72	12	TRE400500	X	
50	75	10	TRE500500	X	
50	80	8	TRED00500	X	X
50	80	10	TRE600500	X	X
50	90	8	TRE800500	X	
50	90	10	TRE900500	X	X
52	68	8	TREA00520	X	X
52	72	8	TREB00520	X	X
52	72	10	TRE000520	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
52	85	10	TRE400520		X
52	100	10	TRE5P0520	X	
54	72	10	TRE000540	X	
54	72.5	9	TRE100540	X	
55	68	8	TRE000550	X	X
55	70	8	TREA00550	X	X
55	70	10	TREH00550	X	
55	72	8	TREB00550	X	X
55	72	10	TRE200550	X	X
55	75	8	TRE300550	X	X
55	75	10	TRE400550	X	X
55	80	8	TREC00550	X	
55	80	10	TRE600550	X	X
55	85	10	TRE700550	X	
55	90	8	TREG00550	X	
55	90	10	TRE800550	X	X
55	100	10	TRE900550	X	
55	110	10	TREJ00550	X	X
56	72	7	TRE200560	X	
56	72	8	TREB00560		X
58	80	8	TREB00580	X	
58	80	10	TRE000580	X	X
60	75	8	TREA00600	X	X
60	75	10	TREH00600	X	
60	80	7	TRE800600	X	
60	80	8	TREB00600	X	X
60	80	10	TRE100600	X	X
60	82	9	TRE200600	X	
60	85	8	TREC00600	X	
60	85	10	TRE300600	X	
60	85	12	TREI00600	X	
60	90	8	TRED00600	X	
60	90	10	TRE400600	X	
60	95	10	TRE500600	X	
60	110	8	TRE900600	X	
60	110	12	TREGP0600	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
62	90	12	TRE3P0620	X	
62	110	10	TRE100620	X	
62	120	12	TRE2P0620	X	
63	80	9	TRE000630	X	
65	80	8	TRE000650	X	
65	85	10	TREA00650	X	X
65	85	12	TRE200650	X	X
65	85	13	TRE300650	X	X
65	90	10	TREB00650	X	X
65	95	10	TRE700650	X	
65	100	10	TREC00650	X	
65	100	12	TRE5P0650	X	
65	120	10	TRE600650	X	
65	120	12	TRE9P0650	X	
68	87	8	TRE200680	X	
68	90	10	TREA00680	X	X
68	94	9	TRE300680	X	
68	110	13	TRE100680	X	
70	85	8	TRE000700	X	
70	90	10	TREA00700	X	X
70	90	12	TRE100700	X	
70	95	13	TRE200700	X	
70	100	10	TREB00700	X	X
70	110	8	TRE700700	X	
70	110	12	TREFP0700	X	
70	110	13	TRE400700	X	
70	120	10	TRE500700	X	
70	125	12	TRE600700	X	
72	86	7	TRE100720	X	
72	95	12	TREAP0720	X	
72	140	12	TRE3P0700	X	
75	90	10	TREC00750	X	
75	95	8	TRE000750	X	X
75	95	9	TRE600750	X	
75	95	10	TREA00750	X	X
75	95	12	TREF00750	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
75	100	10	TREB00750	X	X
75	100	12	TRE100750	X	
75	100	13	TRE200750	X	
75	110	13	TRE500750	X	
75	115	10	TRE800750	X	
75	115	12	TRE900750	X	
75	120	12	TRE300750	X	
79	120	13	TRE000790	X	
80	100	7	TRE000800	X	
80	100	10	TREA00800	X	X
80	100	12	TRE500800	X	
80	105	13	TRE200800	X	
80	110	10	TREB00800	X	X
80	115	10	TRE300800	X	
80	120	13	TRE400800	X	
80	140	13	TRE900800	X	
80	140	15	TRE600800	X	
85	100	13	TRE900850	X	
85	105	10	TRE100850	X	
85	105	12	TRE800850		X
85	110	12	TREA00850	X	X
85	120	10	TRE300850	X	
85	120	12	TREB00850		X
85	130	10	TRE400850	X	
85	130	12	TRE700850	X	X
85	130	13	TRE500850		X
85	140	12	TREG00850	X	
85	150	12	TRE600850	X	
90	110	8	TRE600900		X
90	110	12	TREA00900	X	X
90	110	13	TRE000900	X	X
90	120	12	TREB00900	X	
90	120	13	TRE200900	X	
90	140	12	TRE400900	X	
95	115	7	TRE800950	X	
95	115	12	TRE000950	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
95	115	13	TRE100950	X	X
95	120	12	TREA00950	X	
95	120	13	TRE200950	X	
95	125	12	TREB00950	X	X
95	130	13	TRE300950	X	
100	120	10	TRE001000	X	
100	120	12	TREA01000	X	X
100	125	12	TREB01000	X	
100	125	13	TRE101000	X	
100	130	12	TREC01000	X	X
100	130	13	TRE201000	X	
100	150	12	TRE501000	X	
100	160	14	TRE301000	X	
100	180	12	TRE401000	X	
105	120	7	TRE001050	X	
105	125	13	TRE101050	X	
105	130	12	TREA01050	X	
105	140	12	TREB01050	X	
105	140	13	TRE401050		
110	130	12	TREA01100	X	
110	140	12	TREB01100	X	X
110	140	13	TRE401100	X	
110	140	15	TRE501100	X	
110	170	14	TRE301100	X	
115	140	12	TREA01150	X	X
115	140	15	TRE301150		
118	150	12	TRE001180	X	
120	140	13	TRE001200	X	
120	142	12	TRE501200	X	
120	150	12	TREA01200	X	X
120	150	15	TRE201200	X	X
120	160	12	TREB01200	X	
120	200	14	TRE301200	X	
125	150	12	TREA01250	X	
125	155	14	TRE301250	X	
125	160	15	TRE401250	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
130	160	7.5	TRE401300	X	
130	160	12	TREA01300	X	
130	160	15	TRE001300	X	
130	230	14	TRE201300	X	
135	160	15	TRE001350	X	
135	165	13	TRE201350	X	
135	170	12	TREA01350	X	X
140	160	13	TRE001400	X	
140	170	14	TRE401400		X
140	170	15	TREA01400	X	X
140	210	15	TRE301400	X	
145	175	15	TREA01450	X	X
148	170	14	TRE001480	X	
150	180	13	TRE001500	X	
150	180	15	TREA01500	X	X
155	180	15	TRE001550	X	
160	190	15	TREA01600	X	X
160	200	15	TRE001600	X	
165	190	8	TRE101650	X	
165	190	13	TRE201650	X	
170	200	7.5	TRE301700	X	
170	200	15	TREA01700	X	X
180	200	13	TRE101800	X	
180	210	15	TREA01800	X	X
180	215	15	TRE201800	X	
190	220	12	TRE001900	X	
190	220	15	TREA01900	X	X
200	230	15	TREA02000	X	X
210	240	15	TREA02100	X	
220	250	15	TREA02200	X	
230	260	15	TREA02300	X	
240	270	15	TREA02400	X	X
250	280	15	TREA02500	X	
260	280	16	TRE002600	X	
260	300	20	TREA02600	X	
280	320	20	TREA02800	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
300	340	18	TRE003000	X	
300	340	20	TREA03000	X	
320	360	20	TREA03200	X	
350	380	16	TRE003500	X	
360	400	20	TREA03600		X
394	420	16	TRE003940	X	
420	470	20	TRE004200	X	
440	480	20	TREA04400	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



■ Trelleborg Sealing Solutions type TRC

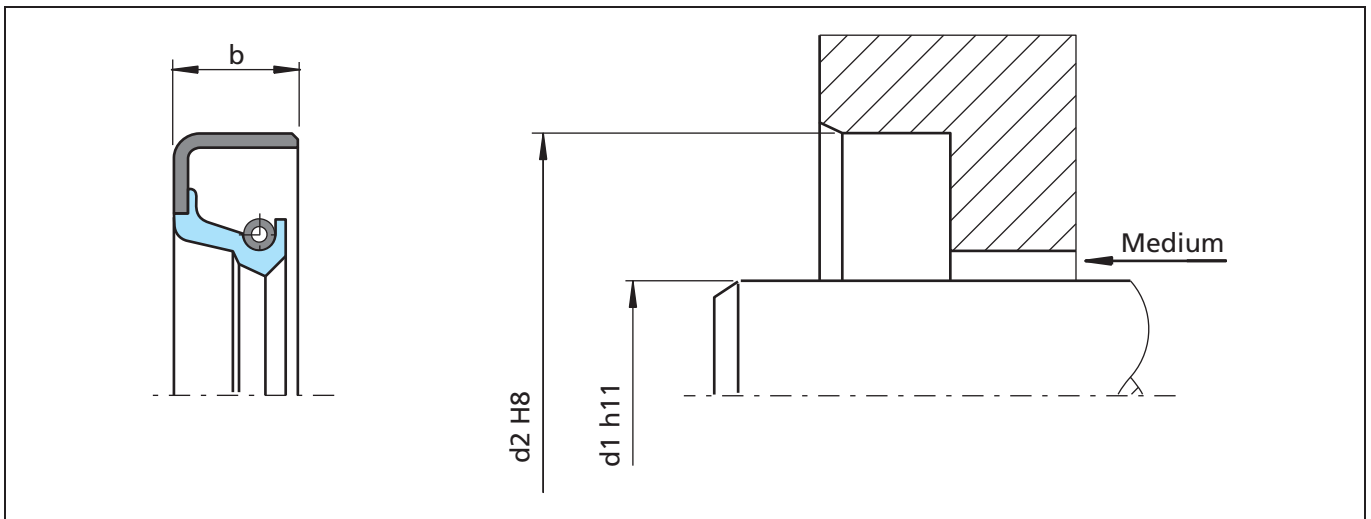


Figure 16 Installation drawing

General description

Trelleborg Sealing Solutions type TRC are metal cased radial lip seals. This type is not recommended for use in heavily polluted environments. As the static sealing between housing and metallic shell is limited, low viscosity media can "creep". Better performance can be achieved with Epoxy-based resin O.D. coating. This special treatment is on request.

Advantages

- Good radial stiffness, especially for large diameters
- Good fitting stability avoiding pop-out of the seal
- Modern lip design provides low radial forces
- Cost effective
- Suitable for use in combination with axial seal (V-Ring and GAMMA-seal)

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools
- Heavy engineering applications

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 30 m/s (depending on material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table X Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: C
 Code: TRC
 Dimensions: Shaft diameter 20 mm
 Housing diameter 35 mm
 Width 7 mm
 Material: NBR
 Material Code: N7MM

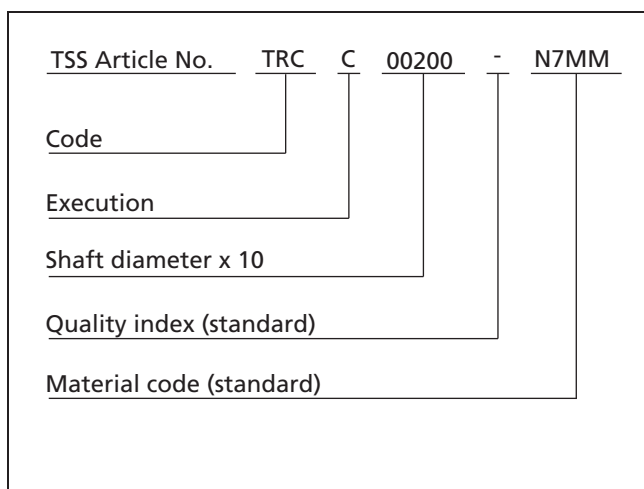


Table XI Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
8	16	7	TRC000080	X	
10	19	7	TRC100100	X	
12	22	7	TRCA00120	X	
12	24	7	TRCB00120	X	
12	28	7	TRCC00120	X	
12	32	7	TRC100120	X	
14	24	7	TRCA00140		
15	24	7	TRC000150	X	
15	26	7	TRCA00150	X	
15	28	7	TRC200150	X	
15	30	7	TRCB00150	X	
16	24	7	TRC000160	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996. () values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
16	28	7	TRCA00160		X
16	30	7	TRCB00160	X	
17	28	7	TRCA00170	X	
17	30	7	TRCB00170	X	
17	34	4	TRC000170	X	
17	35	7	TRCD00170	X	
18	24	4	TRC000180		X
20	30	7	TRCA00200	X	
20	32	7	TRCB00200	X	X
20	35	7	TRCC00200	X	
20	40	7	TRCD00200	X	
20	42	7	TRC300200	X	X
20	47	7	TRCE00200	X	
20	52	7	TRC400200	X	
22	32	7	TRCA00220	X	X
22	35	7	TRCB00220	X	
22.22 (0.87")	35.03 (1.38")	7.90 (0.31")	TRC000222	X	
24	35	7	TRCA00240	X	
25	35	7	TRCA00250	X	
25	37	7	TRC000250	X	
25	38	7	TRC100250	X	
25	40	7	TRCB00250	X	
25	47	7	TRCD00250	X	
25	52	7	TRCE00250	X	
26	37	7	TRCA00260	X	
26.5	47	7	TRC000265	X	
27	37	7	TRC000270	X	X
28	40	7	TRCA00280	X	
28	47	7	TRCB00280	X	
28	47	8	TRC200280	X	
30	40	7	TRCA00300	X	
30	42	7	TRCB00300	X	X
30	43	8	TRC600300	X	
30	45	8	TRC700300	X	X
30	47	7	TRCC00300	X	
30	50	7	TRC100300	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
() values in brackets are inch sizes.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
30	52	7	TRCD00300	X	
30	62	7	TRCE00300	X	
31.5	52	7	TRC000315	X	
32	42	7	TRC000320	X	X
32	45	7	TRCA00320	X	
32	47	7	TRCB00320	X	
32	52	7	TRCC00320	X	
34	52	10	TRC100340	X	
35	45	7	TRC000350	X	X
35	47	7	TRCA00350	X	
35	52	6	TRC300350	X	
35	52	7	TRCC00350	X	
35	52	8.8	TRCL00350	X	
35	55	12	TRCM00350	X	
35	57.2	10	TRCN00350	X	
35	62	7	TRCD00350	X	
35	62	12	TRC700350	X	X
35	72	10	TRC800350	X	
35	72	12	TRC900350	X	
38	52	7	TRCA00380	X	X
38	52	10	TRC100380	X	
38	54	10	TRC300380	X	
40	52	5.5	TRCI00400	X	
40	52	7	TRCA00400	X	
40	55	7	TRCB00400	X	
40	55	10	TRCG00400	X	
40	57.2	10	TRCJ00400	X	
40	58	12	TRCK00400	X	
40	62	7	TRCC00400	X	
40	65	9	TRCH00400	X	
40	72	7	TRCD00400	X	
41	56	7	TRC000410	X	
42	55	7	TRC000420	X	
42	62	10	TRC100420	X	
45	55	7	TRC000450	X	
45	59.1	10	TRCF00450	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
45	60	7	TRC100450	X	
45	60	8	TRCA00450	X	
45	62	8	TRCB00450	X	
45	65	10	TRC400450	X	
45	85	10	TRC800450	X	
48	62	8	TRCA00480	X	
48	62	10	TRC100480		X
48	75	8	TRC000480	X	
50	62	7	TRC000500	X	
50	65	8	TRCA00500	X	X
50	68	10	TRC900500	X	
50	72	8	TRCC00500	X	
50	72	10	TRC400500	X	
50	80	8	TRCD00500	X	
50	80	10	TRCF00500	X	
50	80	13	TRCG00500	X	
52	72	12	TRC100520	X	
55	70	8	TRCA00550	X	
55	72	8	TRCB00550	X	
55	72	10	TRC000550	X	
55	80	8	TRCC00550	X	
55	80	10	TRC200550	X	
55	85	8	TRCD00550	X	
56	72.6	9.7	TRC000560	X	
60	70	7	TRC000600	X	
60	72	8	TRC100600	X	
60	75	8	TRCA00600	X	
60	80	8	TRCB00600	X	
60	80	10	TRC200600	X	
60	85	8	TRCC00600	X	
60	90	13	TRC700600	X	
65	80	8	TRC000650	X	
65	85	10	TRCA00650	X	
65	90	10	TRCB00650	X	
65	90	13	TRC200650	X	
68	85	10	TRC000680	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
68	90	10	TRCA00680		X
70	85	8	TRC000700	X	
70	90	10	TRCA00700	X	
70	95	10	TRC300700	X	
70	95	13	TRC600700	X	
70	100	10	TRCB00700	X	
70	110	10	TRC200700	X	
75	95	5	TRC000750	X	
75	95	10	TRCA00750	X	
75	95	13	TRC200750	X	
75	100	10	TRCB00750	X	X
80	100	10	TRCA00800	X	
80	100	13	TRC000800	X	
80	110	10	TRCB00800	X	
80	110	12	TRC500800	X	
85	100	9	TRC000850	X	
85	105	10	TRC100850	X	
85	110	12	TRCA00850	X	
90	110	8	TRC000900	X	
90	110	12	TRCA00900	X	
90	120	12	TRCB00900	X	
95	110	9	TRC000950	X	
95	115	13	TRC100950	X	
95	120	12	TRCA00950	X	
96	135.7	12	TRC000960	X	
100	115	9	TRC001000	X	
100	120	8	TRC101000	X	X
100	120	10	TRC201000	X	
100	120	12	TRCA01000	X	
100	130	12	TRCC01000	X	X
105	125	12	TRC001050	X	
105	125	13	TRC201050	X	
105	130	12	TRCA01050	X	
110	130	12	TRCA01100	X	
110	140	12	TRCB01100	X	
110	150	15	TRC201100	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
120	140	12	TRC301200	X	
120	140	13	TRC001200	X	
120	150	15	TRC101200		X
125	150	12	TRCA01250	X	
130	160	12	TRCA01300	X	
130	160	13	TRC001300	X	
140	160	13	TRC101400	X	
140	170	13	TRC201400		X
160	185	10	TRC101600	X	
160	190	15	TRCA01600	X	
170	200	15	TRCA01700	X	X
180	210	15	TRCA01800	X	X
260	300	20	TRCA02600	X	
270	310	16	TRC002700		X
275	294	12	TRC102750	X	
340	372	16	TRC103400	X	
350	380	16	TRC003500	X	
370	410	15	TRC003700	X	
460	500	20	TRCA04600	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.



■ Trelleborg Sealing Solutions type TRD

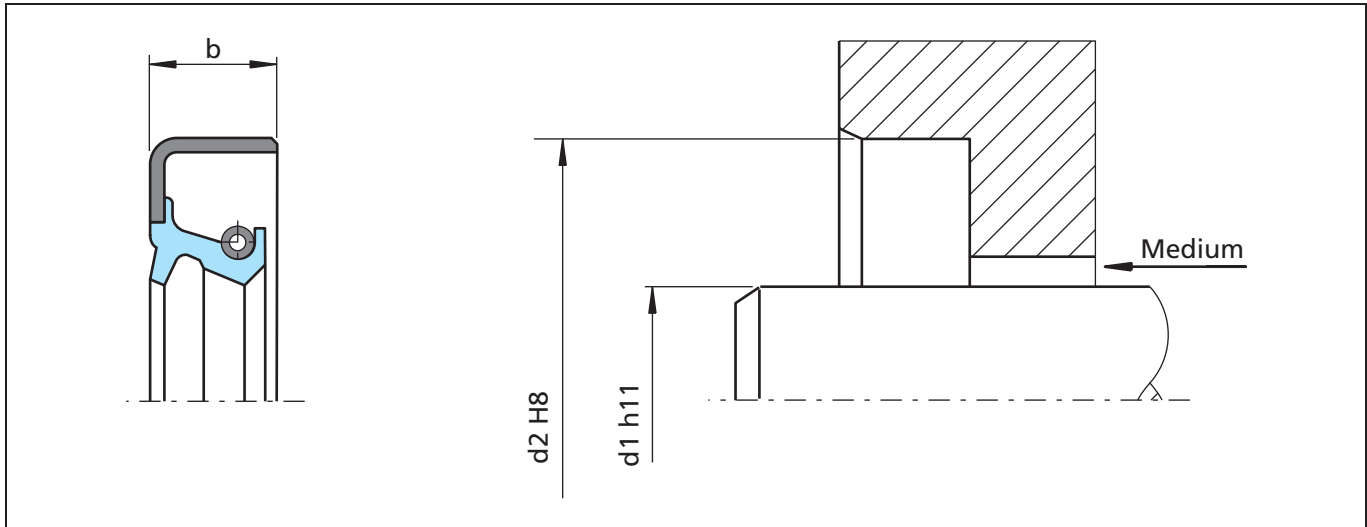


Figure 17 Installation drawing

General description

Trelleborg Sealing Solutions type TRD are metal cased radial lip seals. The additional dust lip protects the main sealing lip against dust and other fine solid contaminants and therefore this type is recommended for use in polluted environments. To achieve a long lifetime a suitable lubricant between the two sealing lips should be applied. As the static sealing between housing and metallic shell is somewhat limited, low viscosity media can "creep". Better performance can be achieved with epoxy based resin O.D. coating. This special treatment is on request.

Advantages

- Effective protection against air side contaminants
- Good radial stiffness, especially for large diameters
- Good fitting stability avoiding pop-out of the seal
- Modern lip design provides low radial forces
- Cost effective

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools
- Heavy engineering applications

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 30 m/s (depending on material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Table XII Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: D
 Code: TRD
 Dimensions: Shaft diameter 40 mm
 Housing diameter 52 mm
 Width 7 mm
 Material: NBR
 Material Code: N7MM

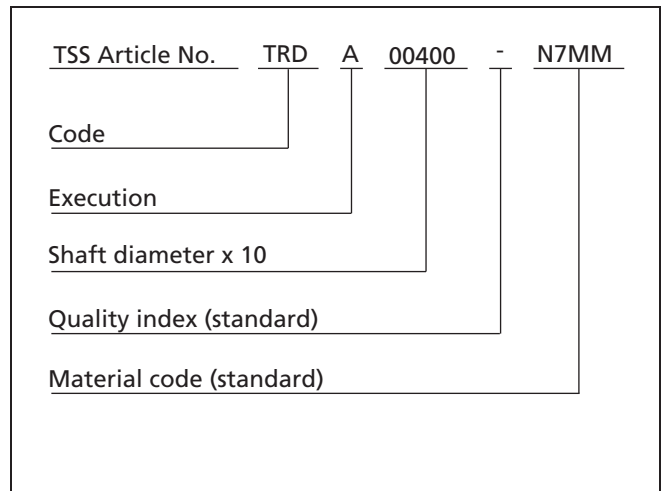


Table XIII Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
12	20	4	TRD300120	X	
12	20	5	TRD000120	X	
15	21	4	TRD000150	X	
15	24	7	TRD100150	X	
15	26	4	TRD200150	X	
15	26	6	TRD400150	X	
15	32	10	TRD300150	X	
17	28	5	TRD000170	X	
20	30	7	TRDA00200	X	
20	35	7	TRDC00200	X	
20	42	7	TRD000200	X	
22	40	7	TRDC00220	X	
25	32	7	TRD000250	X	
25	35	6	TRD200250		X
25	40	7	TRDB00250	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
25	42	7	TRDC00250	X	
25	47	7	TRDD00250	X	
25	47	10	TRD100250	X	
25	52	7	TRDE00250	X	
26	40	7	TRD000260		X
30	42	7	TRDB00300	X	
30	50	7	TRD100300	X	
30	50	10	TRD200300	X	
30	52	10	TRD000300	X	
35	47	7	TRDA00350	X	
35	50	10	TRD000350	X	
35	50	12	TRD200350	X	
35	52	7	TRDC00350	X	
35	62	12	TRD100350	X	
38	50	7	TRD000380	X	
38	52	7	TRDA00380	X	
40	52	7	TRDA00400	X	
40	54	5.5	TRD400400	X	
40	55	7	TRDB00400	X	
40	60	10	TRD300400	X	
40	62	7	TRDC00400		X
40	90	10	TRD200400	X	
42	55	7	TRD000420	X	
42	58	7	TRD200420	X	
42	62	7	TRD100420	X	X
45	62	7	TRD100450	X	
45	62	8	TRDB00450	X	
45	62	10	TRD200450	X	
45	65	5	TRD300450	X	
45	72	8	TRDD00450	X	X
45	72	12	TRD000450	X	
48	62	7	TRD000480	X	
48	65	12	TRD100480	X	
48	70	9	TRD200480	X	
50	65	8	TRDA00500	X	
50	70	8	TRD100500	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
50	90	10	TRD200500	X	
50.8	66.6	7.92	TRD000508	X	
52	65	9	TRD000520	X	
53.98	69.83	9.52	TRD000539	X	
54	72.5	9	TRD000540	X	
54	74	8	TRD100540	X	
55	70	8	TRDA00550	X	
55	72	10	TRD100550	X	
55	80	8	TRDC00550	X	
55	90	10	TRD000550	X	
57	72	9	TRD000570	X	
58	72	8	TRDA00580	X	
58	75	15	TRD000580	X	
60	80	8	TRDB00600	X	
60	80	10	TRD200600		X
60	80	13	TRD000600	X	
60	82	12	TRD100600	X	
61	85	13	TRD000610	X	
65	90	13	TRD100650	X	
65	100	13	TRD000650	X	
68	90	13	TRD000680	X	
70	85	8	TRD000700	X	
70	90	10	TRDA00700	X	
70	90	13	TRD200700	X	
70	100	12	TRD100700	X	
74	90	10	TRD000740	X	
75	95	12	TRD100750	X	
75	95	13	TRD200750		X
75	100	13	TRD000750	X	X
78	100	10	TRDA00780	X	
79	120	13	TRD000790	X	
80	100	12	TRD100800	X	
80	100	13	TRD200800	X	
80	105	13	TRD000800		X
85	115	13	TRD000850	X	
90	110	13	TRD000900	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
90	115	12	TRD200900	X	
100	130	12	TRDC01000	X	
100	130	13	TRD001000	X	
105	130	13	TRD001050	X	
120	140	13	TRD001200	X	
120	150	12	TRDA01200	X	
120	150	14	TRD101200	X	
125	150	13	TRD001250	X	
130	160	13	TRD101300	X	
140	170	14	TRD001400	X	
140	170	15	TRDA01400	X	
145	170	13	TRD001450	X	
146	170	14	TRD001460	X	
148	170	14.5	TRD001480	X	
150	180	15	TRDA01500	X	
155	180	15	TRD001550	X	
160	180	10	TRD001600	X	
165	190	13	TRD001650		X
170	200	15	TRDA01700	X	
180	200	15	TRD001800	X	
190	220	12	TRD001900		X
200	240	20	TRD002000	X	
230	260	20	TRD002300	X	
265	290	16	TRD002650		X
270	310	16	TRD002700	X	
280	310	16	TRD202800		X
290	330	16	TRD002900	X	
400	440	20	TRDA04000	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.



■ Trelleborg Sealing Solutions type TRB

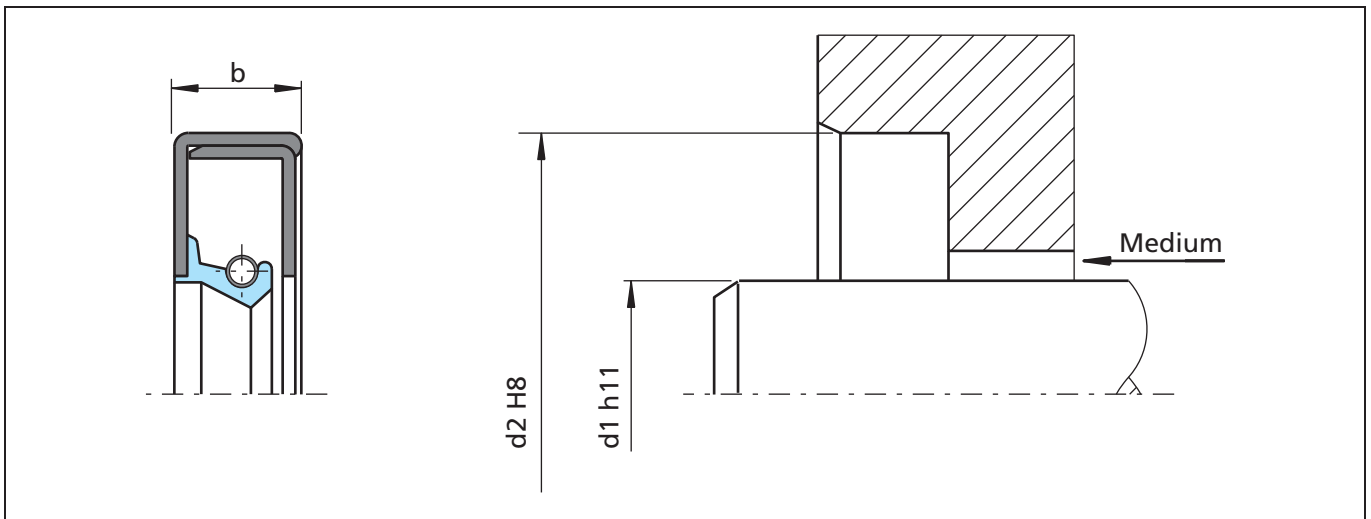


Figure 18 Installation drawing

General description

Trelleborg Sealing Solutions type TRB are reinforced metal cased radial lip seals. The supplementary metal inner ring provides a superior stiffness. This type is not recommended for use in heavily polluted environments. As the static sealing between housing and metallic shell is limited, low viscosity media can "creep". Better performance can be achieved with epoxy based resin O.D. coating. This special treatment is on request.

Advantages

- Superior radial stiffness, especially for very large diameters
- Very good fitting stability avoiding pop-out of the seal
- Modern lip design provides low radial forces
- Cost effective
- Suitable for use in combination with axial seal (V-Ring and GAMMA-seal)

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools
- Heavy engineering applications (e.g. mills in steel industry)

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 30 m/s (depending on material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table XIV Materials

Standard material*	TSS material Code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: B
 Code: TRB
 Dimensions: Shaft diameter 45 mm
 Housing diameter 60 mm
 Width 10 mm
 Material: NBR
 Material Code: N7MM

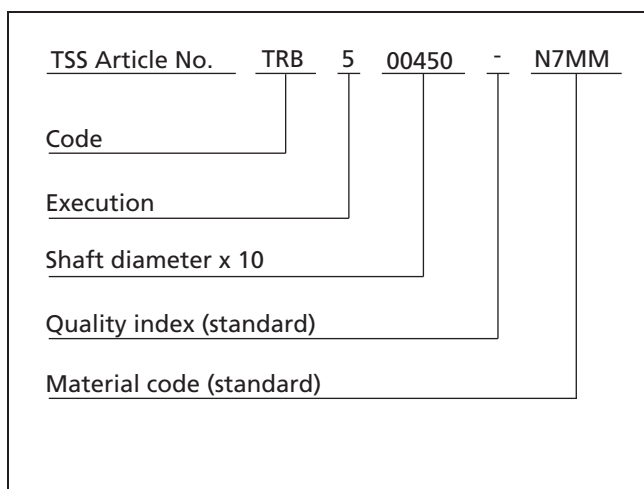


Table XV Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
20	47	10	TRB100200	X	
22	40	9	TRB200220	X	
22	47	9	TRB300220	X	
22	47	10	TRB000220	X	
25	35	7	TRBA00250	X	
25	45	10	TRB600250	X	
25	47	9	TRB700250	X	
25	50	10	TRB800250	X	
28	47	9	TRB000280	X	
30	47	9	TRB800300	X	
30	47	10	TRB100300	X	
30	50	10	TRB300300	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

() values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d₁	d₂	b		NBR	FKM
30	52	12	TRB200300	X	
35	50	9	TRB000350	X	
35	52	9	TRBG00350		
35	56	10	TRB300350		X
35	62	9	TRB600350	X	
35	62	10	TRB700350	X	
35	72	12	TRB800350	X	
35	80	13	TRBF00350	X	
38	55	12	TRB200380	X	
40	60	10	TRB200400	X	
40	62	9	TRB100400	X	
40	62	10	TRB300400	X	
40	62	12	TRB400400	X	
40	68	10	TRB700400	X	
40	68	12	TRB800400	X	X
40	90	9	TRB600400	X	
45	60	10	TRB500450	X	
45	62	10	TRB100450	X	
45	65	10	TRB200450	X	
45	72	10	TRB600450	X	
45	72	12	TRB000450	X	
45	75	10	TRBG00450	X	
48	65	12	TRB000480	X	
50	68	10	TRB200500	X	
50	70	10	TRB900500	X	
50	72	10	TRB600500	X	
50	72	12	TRB700500	X	
50	80	10	TRB800500	X	
50.80 (2.00")	73.10 (2.88")	12.70 (0.50")	TRB000508	X	
52	68	10	TRB100520	X	
52	72	10	TRB000520	X	
52	72	12	TRB200520	X	
52	80	13	TRB300520	X	
54	80	10	TRB000540	X	
55	72	10	TRB000550	X	
55	72	12	TRB600550	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
() values in brackets are inch sizes.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
55	80	10	TRB200550	X	
55	85	13	TRB800550	X	
55	100	13	TRB500550	X	
58	80	10	TRB000580	X	
60	75	8	TRBA00600	X	
60	80	10	TRB000600	X	X
60	85	10	TRB100600	X	
60	90	10	TRB300600	X	X
65	85	10	TRBA00650	X	
65	85	12	TRB000650	X	
65	90	10	TRBB00650	X	
65	90	12	TRB200650	X	
65.10 (2.56")	92.20 (3.63")	12.70 (0.50")	TRB000651	X	
66.70 (2.63")	88.50 (3.48")	12.70 (0.50")	TRB000667	X	
66.70 (2.63")	92.20 (3.63")	12.70 (0.50")	TRB100667	X	
68	90	10	TRBA00680	X	X
68	90	12	TRB000680	X	
69.85 (2.75")	90.12 (3.55")	12.70 (0.50")	TRB000698	X	
70	90	10	TRBA00700	X	
70	90	12	TRB000700	X	X
70	95	10	TRB300700	X	
70	100	12	TRB200700	X	
70	105	13	TRB400700	X	
73.02 (2.87")	95.40 (3.76")	12.70 (0.50")	TRB100730	X	
74	90	10	TRB000740	X	
75	90	10	TRB600750		X
75	95	12	TRB500700	X	X
75	100	10	TRBB00750	X	
75	100	12	TRB400750	X	X
75	110	13	TRB200750	X	
75	115	13	TRB300750	X	
76.20 (3.00")	95.40 (3.76")	12.70 (0.50")	TRB000762	X	
76.20 (3.00")	98.60 (3.88")	11.90 (0.47")	TRB100762	X	
76.20 (3.00")	101.80 (4.00")	11.90 (0.47")	TRB200762	X	
80	100	10	TRBA00800	X	
80	100	12	TRB000800	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
() values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
80	100	13	TRB600800	X	
80	105	13	TRB100800	X	
80	110	12	TRB200800	X	
80	120	13	TRB400800	X	
85	105	13	TRB500850	X	
85	110	12	TRBA00850		X
85	110	13	TRB100850	X	X
85	110	15	TRB600850	X	
85	115	13	TRB200850	X	
85	130	13	TRB400850	X	
85.72 (3.37")	108.05 (4.25")	12.70 (0.50")	TRB000857	X	
90	110	8	TRB000900	X	
90	110	12	TRBA00900		X
90	110	13	TRB200900	X	
90	120	13	TRB300900	X	
90	120	15	TRB400900	X	
90	130	13	TRB500900	X	
90	140	13	TRB600900	X	
95	115	13	TRB000950	X	
95	120	12	TRBA00950		X
95	120	13	TRB100950	X	X
95	120	15	TRB500950	X	
95	125	13	TRB200950	X	
95	125	15	TRB600950	X	
95	130	13	TRB300950	X	
98.42 (3.87")	120.81 (4.76")	12.70 (0.50")	TRB000984	X	
98.42 (3.87")	127.10 (5.00")	11.91 (0.47")	TRB100984	X	
100	115	9	TRB001000		X
100	120	12	TRBA01000		X
100	120	13	TRB101000	X	
100	125	13	TRB501000	X	
100	130	13	TRB201000	X	
100	140	13	TRB601000	X	
101.60 (4.00")	127.10 (5.00")	12.70 (0.50")	TRB101016	X	X
105	125	13	TRB001050	X	
105	130	13	TRB101050	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
() values in brackets are inch sizes.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
105	130	15	TRB201050	X	
105	140	15	TRB501050	X	
110	130	13	TRB101100	X	
110	130	15	TRB601100	X	
110	140	13	TRB501100	X	
110	140	15	TRB301100	X	
110	145	15	TRB701100	X	
110	150	13	TRB401100	X	
110	150	15	TRB001100	X	
114.30 (4.50")	139.85 (5.50")	12.70 (0.50")	TRB001143	X	
115	140	13	TRB001150	X	
115	140	15	TRB101150	X	
115	150	15	TRB201150	X	
120	140	13	TRB001200	X	
120	145	14.5	TRB501200	X	
120	150	13	TRB101200	X	
120	150	15	TRB201200	X	X
120	160	13	TRB301200	X	
120	160	15	TRB401200	X	X
125	150	13	TRB001250	X	
125	150	15	TRB301250	X	
125	160	15	TRB501250	X	
127.00 (5.00")	158.90 (6.25")	12.70 (0.50")	TRB001270	X	
130	160	13	TRB101300	X	
130	160	15	TRB401300	X	X
130	170	15	TRB501300	X	
130	180	15	TRB301300	X	
135	160	13	TRB001350	X	
135	160	15	TRB101350	X	
135	170	15	TRB201350	X	
140	160	13	TRB001400	X	
140	165	12	TRB401400	X	
140	170	13	TRB101400	X	
140	170	15	TRBA01400	X	X
140	180	15	TRB201400	X	
140	190	15	TRB301400	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
145	165	13	TRB001450	X	
145	170	13	TRB101450	X	
145	170	15	TRB201450	X	
145	175	15	TRBA01450	X	
145	180	15	TRB301450	X	
150	170	15	TRB201500	X	
150	180	13	TRB001500	X	
150	180	15	TRBA01500	X	X
155	180	15	TRB001550	X	
160	180	15	TRB001600	X	
160	185	10	TRB101600	X	
160	190	15	TRBA01600	X	X
165	190	13	TRB001650	X	
165	190	15	TRB101650	X	
165.10 (6.50")	193.88 (7.63")	15.75 (0.62")	TRB001651	X	
170	190	15	TRB101700	X	
170	200	15	TRBA01700	X	X
174.60 (6.87")	200.23 (7.88")	15.90 (0.63")	TRB001746	X	
175	200	15	TRB001750	X	
175	205	15	TRB101750	X	
180	210	15	TRBA01800	X	
180	220	16	TRB001800	X	
190	215	16	TRB001900	X	
190	220	15	TRBA01900	X	
200	230	15	TRBA02000	X	X
200	230	16	TRB102000	X	
200	250	15	TRB002000	X	
210	240	15	TRBA02100	X	X
220	250	15	TRB002200	X	
230	260	15	TRBA02300	X	
240	270	15	TRBA02400	X	X
250	280	15	TRBA02500	X	
260	290	16	TRB002600	X	X
260	300	20	TRBA02600	X	X
280	310	16	TRB002800	X	X
280	320	20	TRBA02800	X	X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
() values in brackets are inch sizes.



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
290	330	18	TRB202900	X	
300	332	16	TRB003000	X	
300	340	20	TRBA03000	X	
310	350	18	TRB003100	X	X
320	350	18	TRB003200	X	
320	360	18	TRB103200	X	
320	360	20	TRBA03200	X	
330	370	18	TRB003300	X	
340	372	16	TRB003400	X	
340	380	20	TRBA03400	X	X
350	390	18	TRB003500	X	
360	400	18	TRB003600	X	
360	400	20	TRBA03600	X	X
365	405	18	TRB003650	X	
374.65 (14.75")	419.00 (16.50")	22.20 (0.87")	TRB003746	X	
380	420	20	TRBA03800	X	X
390	430	18	TRB003900	X	
400	440	20	TRBA04000	X	X
420	460	20	TRBA04200	X	
440	470	20	TRB004400	X	
440	480	20	TRBA04400	X	X
460	500	20	TRBA04600	X	
480	520	20	TRBA04800	X	
500	540	20	TRBA05000	X	
560	610	20	TRB005600		X
600	640	20	TRB006000		X
700	750	25	TRB007000	X	
760	800	20	TRB107600	X	

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.



■ Trelleborg Sealing Solutions type TRF

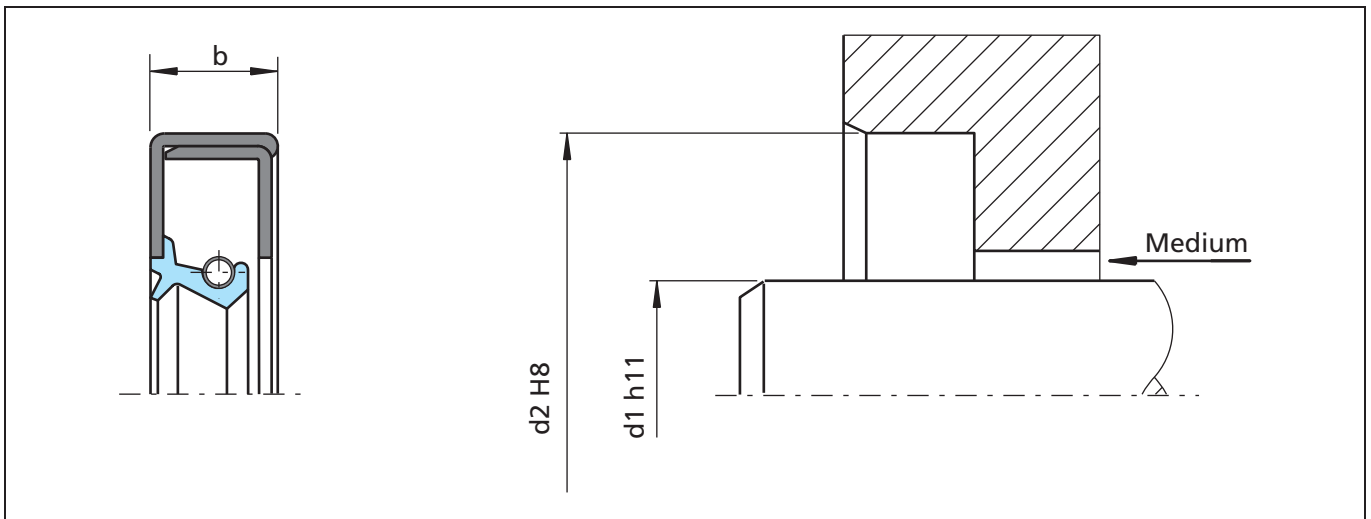


Figure 19 Installation drawing

General description

Trelleborg Sealing Solutions type TRF are reinforced metal cased radial lip seals with dust lip. The supplementary metal inner ring provides a superior stiffness. This type is recommended for use in heavily polluted environments. To achieve a long lifetime a suitable lubricant between the two sealing lips should be applied. As the static sealing between housing and metallic shell is limited, low viscosity media can "creep". Better performance can be achieved with epoxy based resin O.D. coating. This special treatment is on request.

Advantages

- Superior radial stiffness, especially for very large diameters
- Very good fitting stability avoiding pop-out of the seal
- Modern lip design provides low radial forces
- Cost effective
- Suitable for use in combination with axial seal (V-Ring and GAMMA-seal)

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools
- Heavy engineering applications (e.g. mills in steel industry)

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 30 m/s (depending on material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table XVI Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: F
 Code: TRF
 Dimensions: Shaft diameter 110 mm
 Housing diameter 140 mm
 Width 13 mm
 Material: NBR
 Material Code: N7MM

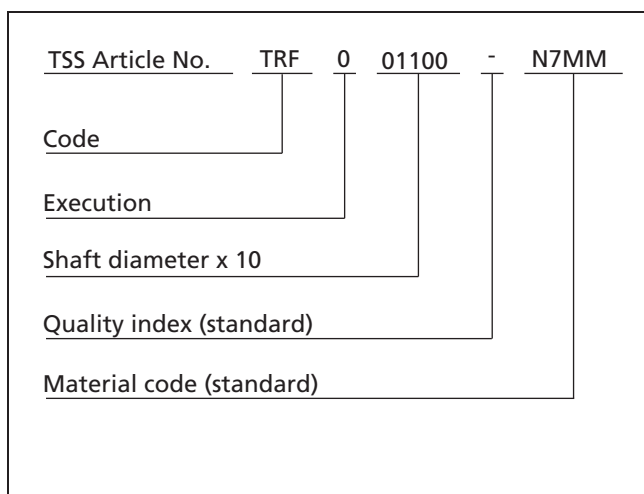


Table XVII Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
35	52	9	TRF000350	X	
45	62	10	TRF100450	X	
45	62	12	TRF000450	X	
50.80 (2.00")	73.13 (2.88")	12.70 (0.50")	TRF000508	X	
58	80	13	TRF000580	X	
60	80	8	TRFB00600	X	
60	80	10	TRF100600	X	
60	80	12	TRF000600	X	
60	90	10	TRF200600	X	
66.7	98.5	11.9	TRF000667	X	
70	90	12	TRF000700	X	
80	100	10	TRFA00800		X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.

() values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
80	100	12	TRF000800	X	
90	120	13	TRF000900	X	
90	130	13	TRF100900	X	
95	120	13	TRF100950	X	
100	125	13	TRF001000	X	
100	130	13	TRF101000		X
105	140	13	TRF001050	X	
110	140	13	TRF001100	X	X
115	140	11	TRF001150	X	
120	140	13	TRF001200		X
120	150	15	TRF101200	X	
125	150	12	TRFA01250		X
130	155	10	TRF001300	X	
130	170	15	TRF101300	X	
132	160	13	TRF001320	X	
140	170	15	TRFA01400	X	
148	170	15	TRF001480	X	
150	180	15	TRFA01500	X	
160	190	15	TRFA01600	X	
170	200	15	TRFA01700	X	
175	200	15	TRF001750	X	
180	210	15	TRFA01800		X
180	215	15	TRF001800	X	
200	225	15	TRF102000	X	
240	270	15	TRFA02400	X	X
250	275	15	TRF002500	X	
275	300	15	TRF002750	X	
275	310	16	TRF102750		X
280	310	16	TRF002800	X	X
280	320	20	TRFA02800	X	
350	390	18	TRF003500	X	
380	420	20	TRF003800	X	X
390	425	18	TRF003900	X	
460	500	20	TRFA04600	X	
600	640	20	TRF006000		X

The dimensions printed in **bold** type correspond to the recommendations in DIN 3760, draft September 1996.
 () values in brackets are inch sizes.



Special types of rotary seals

When the seals designed according the standard of Figure 13, are not able to satisfy the application's specification, special seals are available. The selection guide in Table IV shows the range of seals suitable to fulfill the majority of

industrial applications and meeting DIN 3760/3761 requirements as well. Special seals include:

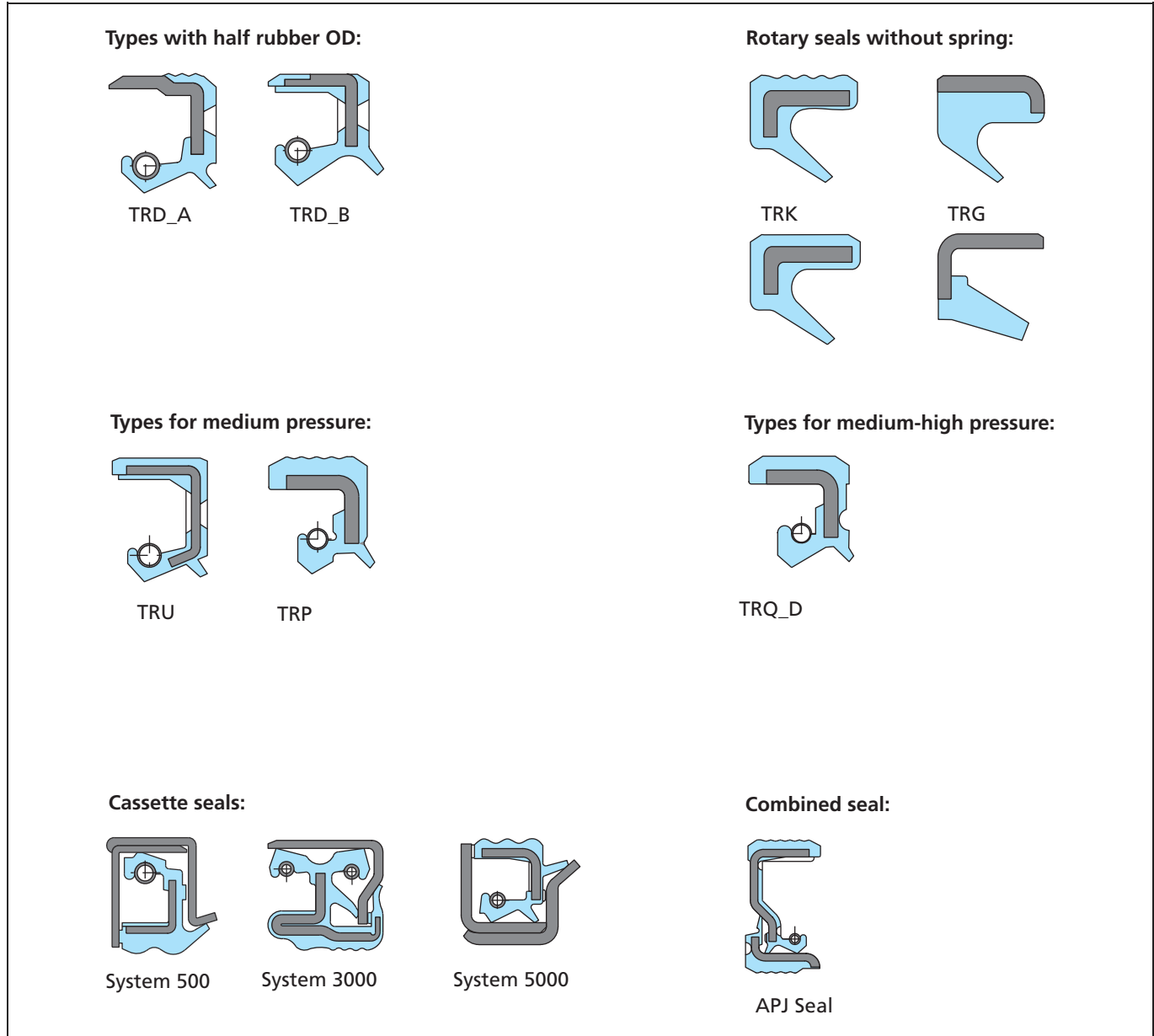


Figure 20 Selection of special radial seals



■ Trelleborg Sealing Solutions types TRD_A / TRD_B

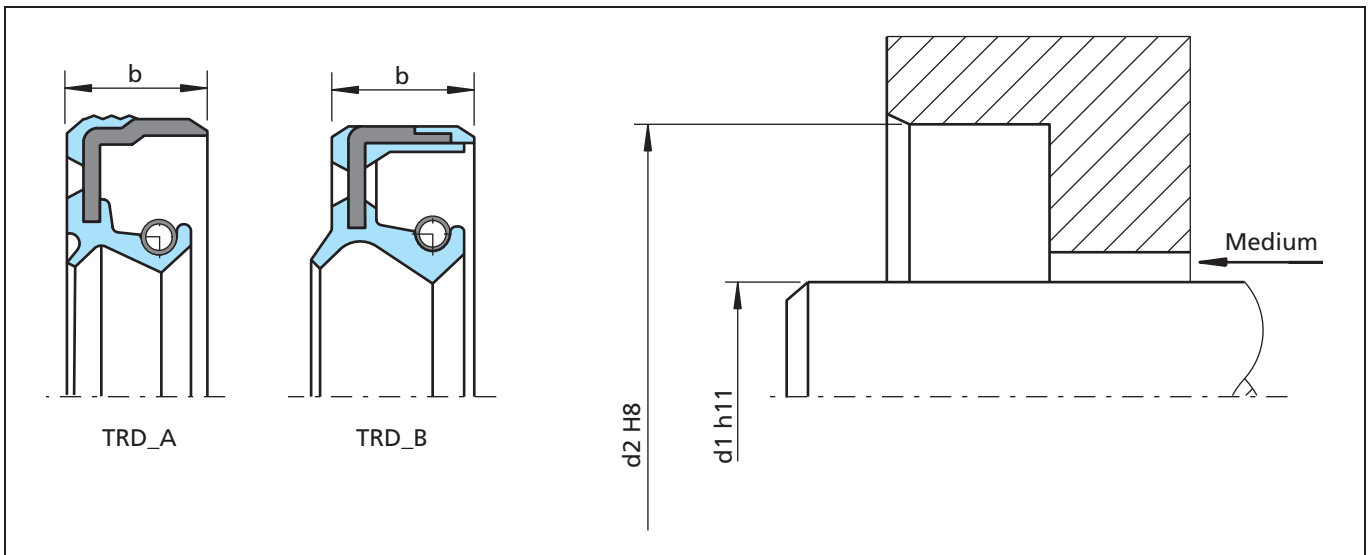


Figure 21 Installation drawing

General description

Trelleborg Sealing Solutions types TRD_A / TRD_B are seals with partially rubber covered Outer Diameter. These seals are designed to assure a high assembly stiffness and a good static sealing together with a good heat transfer. The additional dust lip protects the main sealing lip against dust and other fine solid contaminants, therefore these types are recommended for use in polluted environments. To achieve a long lifetime a suitable lubricant between the two sealing lips should be applied.

Please note that this O.D. design (half & half design) can be delivered on request also for different sealing lip types (e.g. type TRA,TRP, etc.)

Advantages

- Good static sealing and stiffness (No pop-out effect)
- Good thermal expansion compensation
- Good heat transfer
- Effective protection against air side contaminants

Application examples

- Automotive "Power-train" and "Drive-train"
- Automotive servo-pumps
- High speed transmission
- Machine tools

Technical data

Pressure:	up to 0.05 MPa for standard lip profiles
Temperature:	-40 °C to +200 °C (depending on material)
Speed:	up to 30 m/s (depending on material)
Media:	mineral and synthetic oils (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table XVIII Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Remark: These seals are customer tailored products.

For more details please contact your local Trelleborg Sealing Solutions marketing company.



■ Trelleborg Sealing Solutions type TRU - medium pressure oil seal

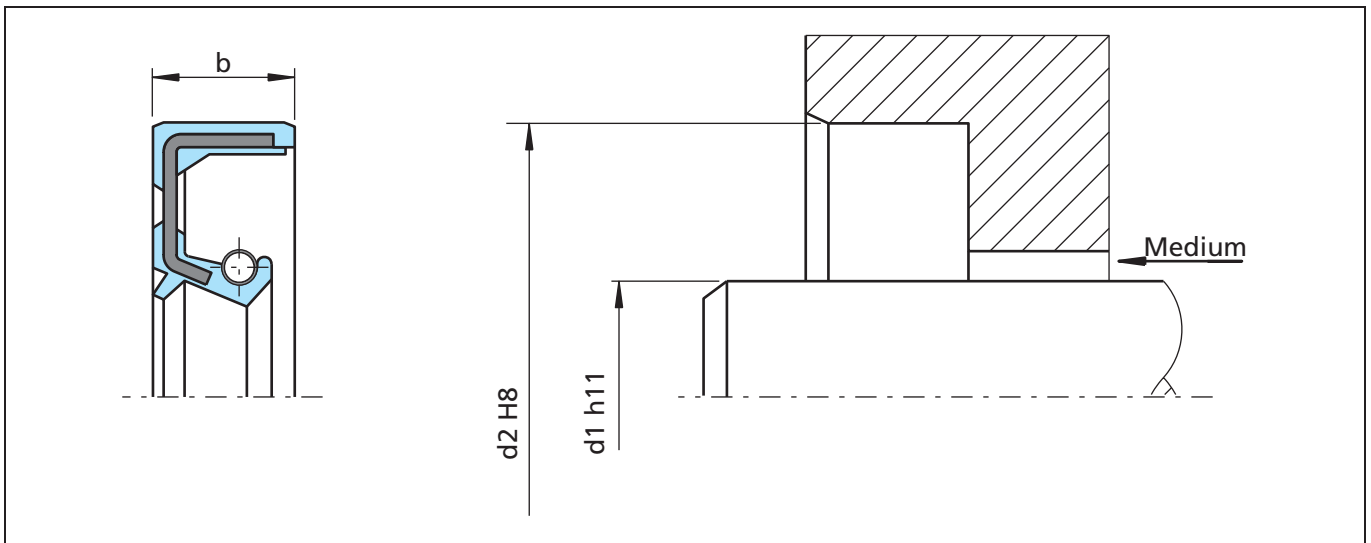


Figure 22 Installation drawing

General description

Trelleborg Sealing Solutions type TRU is a seal with completely rubber covered outer diameter. This type of seal is designed with an extended metallic support of the diaphragm that allows pressures up to 0.5 MPa. In order to avoid a "pop-out" of the seal, we suggest to fit an axial retainer (e.g. circlip, shoulder, etc.). The additional dust lip protects the main sealing lip against dust and other fine solid contaminants and therefore this type is recommended for use in polluted environments. To achieve a long lifetime a suitable lubricant between the two sealing lips should be applied.

Advantages

- Good static sealing
- Compensation of different thermal expansion
- Reduced risk of fretting corrosion
- Up to 0.5 MPa pressure at moderate peripheral speed
- Effective protection against air side contaminants
- No need of back-up ring

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Hydraulic motors
- Machinery industry

Technical data

Pressure:	up to 0.5 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 10 m/s (depending on pressure and material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table XIX Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.
 ** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: U
 Code: TRU
 Dimensions: Shaft diameter 40 mm
 Housing diameter 52 mm
 Width 7 mm
 Material: NBR
 Material Code: N7MM

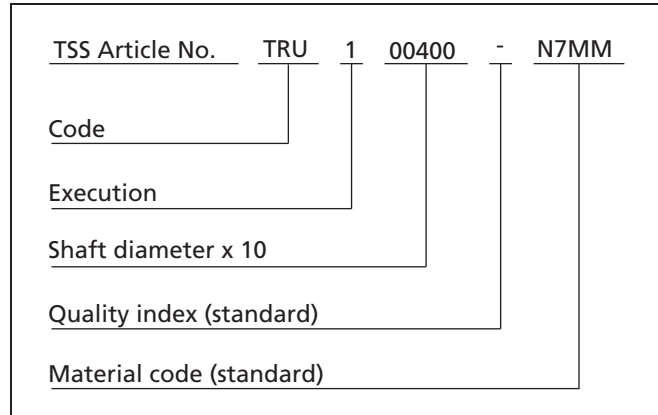


Table XX Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
8	22	7	TRU000080	X	
12	22	6	TRU200120	X	
12	22	7	TRU000120	X	
15	25	6	TRU100150		X
16	28	6	TRU000160		X
17	28	6	TRU000170	X	
20	30	7	TRU200200	X	
20	35	6	TRU300200	X	
20	35	7	TRU100200	X	
20	40	6	TRU000200	X	
22	32	7	TRU100220	X	
22	42	7	TRU200220	X	
22	47	7	TRU000220	X	X
23	40	6	TRU000230		X
25	40	7	TRU000250	X	X
28	40	6	TRU000280		X
28	47	7	TRU100280	X	
29	40	6	TRU000290		X

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
30	42	6	TRU000300	X	X
30	47	7	TRU200300	X	
30	47	8	TRU100300	X	
35	47	7	TRU000350		X
35	50	7.5	TRU300350	X	
35	52	6	TRU100350	X	X
35	56	12	TRU200350	X	
37	47	6	TRU000370		X
40	52	5	TRU000400	X	X
40	52	7	TRU100400	X	
40	55	7	TRUB00400		X
40	55	8	TRU200400	X	
40	56	6	TRU300400	X	X
42	62	7	TRU000420	X	
45	62	7	TRU000450		X
45	65	7	TRU200450	X	
45	65	8	TRU100450	X	
46	60	6	TRU000460		X
47	62	7	TRU000470	X	
50	65	8	TRU200500	X	
50	68	8	TRU000500	X	
50	72	7	TRU100500	X	X
55	72	7	TRU000550		X
55	72	8	TRU200550	X	
55	75	7	TRU100550		X
58	80	10	TRU000580		X
60	75	8	TRU100600		X
60	80	7	TRU000600	X	X
65	85	10	TRU000650	X	
70	90	7	TRU100700	X	
70	90	10	TRU000700		X
80	100	7	TRU000800	X	
85	105	12	TRU000850	X	
90	110	7.5	TRU000900		X
90	110	12	TRU200900	X	
90	125	12	TRU100900	X	



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
95	120	12	TRU000950	X	
100	120	12	TRU001000	X	
120	140	13	TRU001200	X	
120	150	12	TRU101200	X	
135	165	15	TRU001350	X	
140	170	12	TRU001400	X	
140	170	15	TRU101400	X	
160	185	8.5	TRU101600	X	
160	190	15	TRU001600	X	
190	213	8	TRU001900		X
200	230	15	TRU002000	X	



■ Trelleborg Sealing Solutions type TRP - medium pressure oil seal

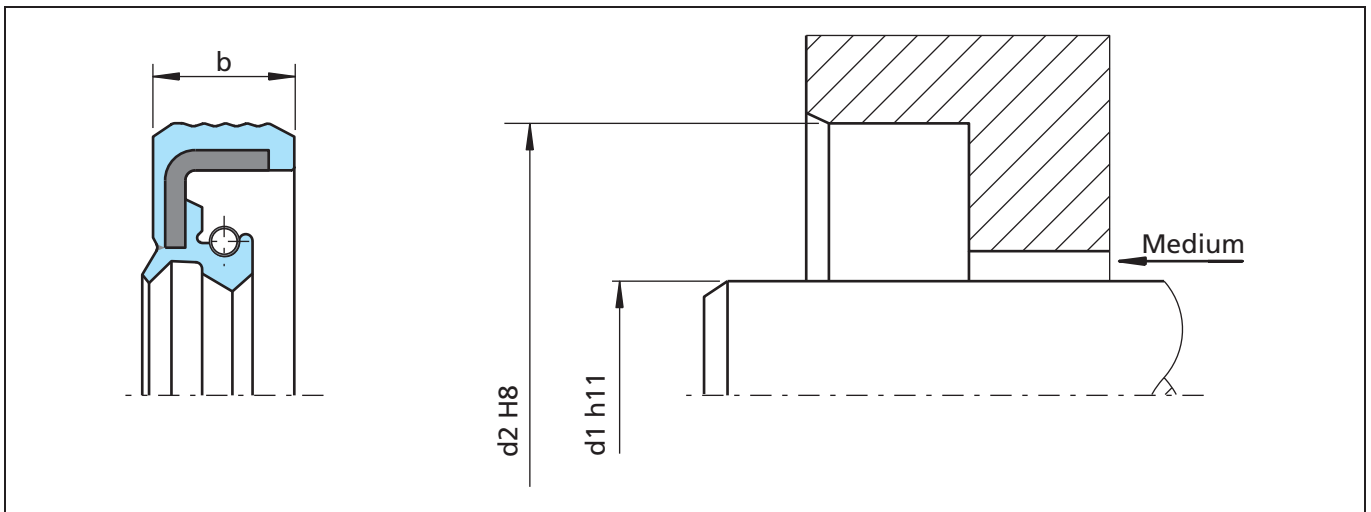


Figure 23 Installation drawing

General description

Trelleborg Sealing Solutions type TRP are seals with completely rubber covered Outer Diameter. This type of seal is designed for pressures up to 0.5 MPa. In order to avoid a “pop-out” of the seal, we suggest to fit an axial retainer (e.g. circlip, shoulder, etc.) The additional dust lip protects the main sealing lip against dust and other fine solid contaminants and therefore this type is recommended for use in polluted environments. To achieve a long lifetime a suitable lubricant between the two sealing lips should be applied.

Advantages

- Good static sealing
- Compensation of different thermal expansion
- Reduced risk of fretting corrosion
- Up to 0.5 MPa pressure at moderate peripheral speed
- Low lip and shaft wear at low pressure run
- Effective protection against air side contaminants
- No need of back-up ring

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Hydraulic motors
- Machinery industry

Technical data

Pressure:	up to 0.5 MPa
Temperature:	-40 °C to +200 °C (depending on material)
Speed:	up to 10 m/s (depending on pressure and material)
Media:	mineral and synthetic lubricants (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Radial Oil Seal

Table XXI Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (70 Shore A)	N7MM	Carbon steel	Carbon steel
NBR (75 Shore A)	4N011		
FKM (70 Shore A)	VCBV	Carbon steel	Stainless steel
FKM (75 Shore A)	4V012		

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: P
 Code: TRP
 Dimensions: Shaft diameter 50 mm
 Housing diameter 72 mm
 Width 7 mm
 Material: NBR
 Material Code: N7MM

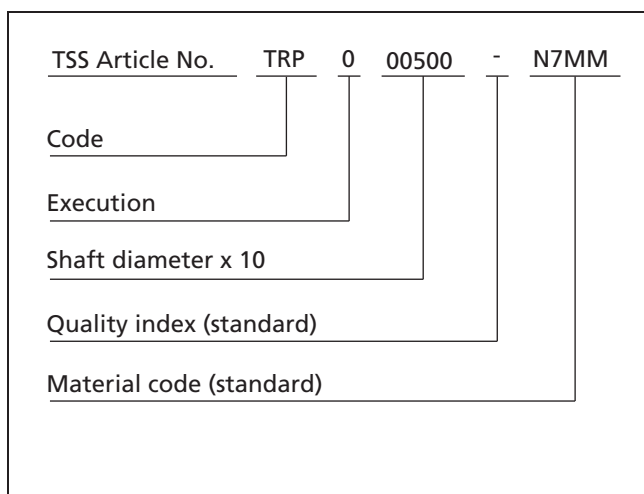


Table XXII Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBRM	FKM
10	22	7	TRP000100	X	
11	22	7	TRPA00110	X	
12	22	6	TRP000120	X	X
13	22	5	TRP000130		X
17	28	7	TRP100170	X	
17	30	7	TRP000170		X
19	27	5	TRP000190	X	
19	32	6	TRP100190		X
20	35	6	TRP100200	X	
20	40	7	TRP000200		X
20	45	6	TRP200200	X	
22	32	6	TRP100220	X	X
22	40	6	TRP000220		X
24	40	7	TRPC00240	X	X
25	35	6	TRP100250	X	X

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBRM	FKM
25	37	6	TRP200250	X	X
25	40	7	TRP000250		X
28	40	6	TRP000280		X
30	42	6	TRP000300	X	X
33	45	5	TRP000330		X
35	47	6	TRP100350	X	X
35	52	6	TRP000350	X	X
36	48	5.5	TRP000360	X	
40	55	7	TRPB00400	X	X
40	62	6	TRP100400	X	
40	67	7	TRP000400		X
42	62	7	TRP000420		X
45	62	7	TRP000450	X	
50	72	7	TRP000500	X	X
52	68	10	TRP000520		X
55	70	7	TRP000550	X	
55	72	7	TRP100550	X	
60	80	7	TRP000600	X	X
70	90	7	TRP000700	X	X
80	100	7	TRP000800		X
85	105	7.5	TRP000850	X	
100	118	7.5	TRP001000	X	
105	125	13	TRP001050		X
155	174	12	TRP001550		X
190	220	12	TRP001900	X	
280	320	16	TRP002800	X	
365	400	12	TRP003650	X	
365	405	15	TRP103650	X	
460	490	12	TRP004600		X



Table XXIII Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (75 Shore A)	4N011	Carbon steel	Carbon steel
FKM (75 Shore A)	4V012	Carbon steel	Stainless steel

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Ordering example oil seal STEFA type

STEFA type: 12CC
 Code: TRQ_D
 Dimensions: Shaft diameter 24 mm
 Housing diameter 40 mm
 Width 6 mm
 Material: NBR 1452
 Material Code: 4N011

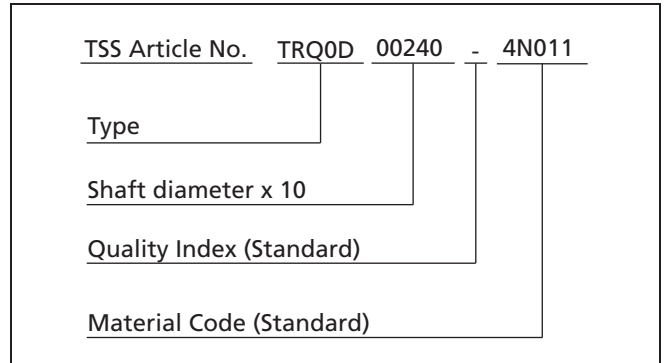


Table XXIV Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
15	25	6	TRQ0D0150	X	
19.5	30	6	TRQ0D0195		X
24	40	6	TRQ0D0240	X	
27	44	7	TRQ0D0270	X	
32	47	6	TRQ0D0320		X
32	48	7	TRQ1D0320	X	
35	52	6	TRQ1D0350		X
35	54	6	TRQ0D0350		X
40	55	7	TRQBD0400		X
45	62	7	TRQ0D0450		X
47	62	7	TRQ0D0470	X	
50	72	7	TRQ0D0500		X
55	70	7	TRQ0D0550		X
55	83	7	TRQ1D0550	X	
60	80	7	TRQ0D0600		X
70	90	7	TRQ0D0700		X



■ Trelleborg Sealing Solutions type TRK

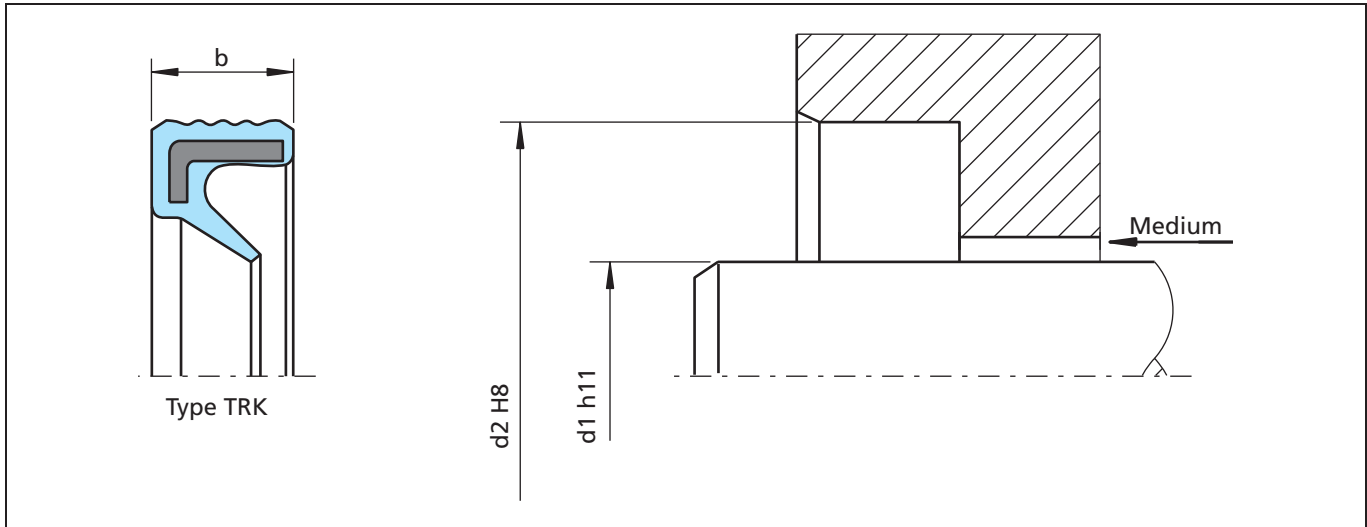


Figure 25 Installation drawing

General description

The Trelleborg Sealing Solutions type TRK are specially designed radial oil seals reinforced with a metal insert but without spring energized sealing lip and a wavy rubber covered outer diameter. STEFA CD type are available with flat rubber covered O.D. These types are not recommended for use in heavily polluted environments.

Advantages

- Good static sealing and thermal expansion compensation
- Low friction and low heat generation
- Extremely compact design
- Low radial force provides a low break-out torque
- Suitable for scraper applications

Application examples

- Roller bearings
- Tooling fixtures (e.g. drilling machines)
- Sealing against viscous media (e.g. grease)
- Supplementary excluders (shaft ends)
- Axle King Pin seals

Technical data

Pressure:	Without pressure
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 10 m/s
Media:	mineral and synthetic base greases

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Table XXV Materials

Standard material*	TSS material code	Standard metal insert**
NBR (70 Shore A)	N7LM	Carbon steel
NBR (75 Shore A)	4N01	
FKM (70 Shore A)	VCBM	Carbon steel
FKM (75 Shore A)	4V01	

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: K
 Code: TRK
 Dimensions: Shaft diameter 17 mm
 Housing diameter 23 mm
 Width 3 mm
 Material: NBR
 Material Code: N7LM

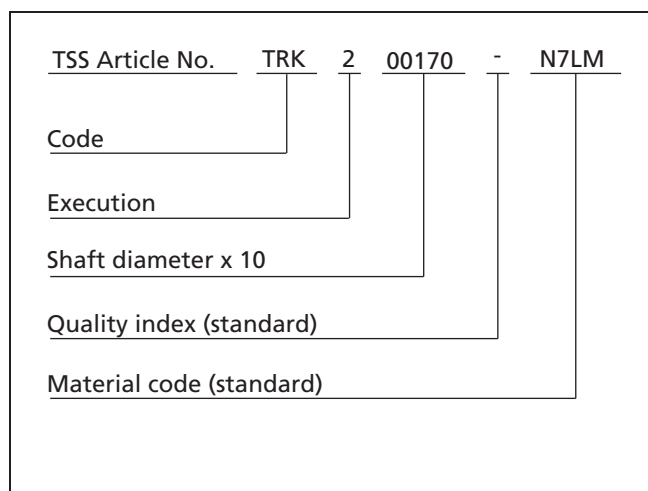


Table XXVI Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
4	8	2	TRK000040	X	
5	9	2	TRK000050	X	X
5	10	2	TRK100050	X	X
6	10	2	TRK000060		X
6	15	4	TRK200060	X	X
7	14	2	TRK100070	X	X
8	12	3	TRK000080	X	
8	15	3	TRK200080	X	X
9	13	3	TRK000090	X	
9	16	3	TRK200090	X	
10	14	3	TRK000100	X	X
10	16	4	TRK500100	X	
10	17	3	TRK100100	X	
10	19	3	TRK200100	X	
10	21	4	TRK300100	X	



Radial Oil Seal

Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
10	26	4	TRK400100	X	
11	15	3	TRK000110	X	
12	16	3	TRK000120	X	
12	18	3	TRK100120	X	X
12	19	3	TRK200120	X	X
12	20	4	TRK300120	X	X
13	19	3	TRK000130	X	
14	20	3	TRK000140	X	X
15	21	3	TRK000150	X	X
15	23	3	TRK100150	X	
16	22	3	TRK000160	X	X
16	24	3	TRK200160	X	
17	23	3	TRK000170	X	
17	23.5	3.4	TRK200170	X	
17	25	3	TRK100170	X	
18	24	3	TRK000180	X	
18	24	4	TRK100180	X	
19	26	4	TRK100190	X	
19	27	4	TRK000190	X	
20	26	3	TRK000200	X	X
20	26	4	TRK100200	X	
20	28	4	TRK200200	X	X
22	28	4	TRK000220	X	
22	30	4	TRK100220	X	X
24	32	4	TRK000240	X	
25	32	4	TRK000250	X	
25	33	4	TRK100250	X	
25	35	4	TRK200250	X	X
26	34	4	TRK000260	X	
28	35	4	TRK000280	X	
28	38	6.5	TRK200280	X	
28	40	6.5	TRK300280	X	
30	37	4	TRK000300	X	X
30	40	4	TRK100300	X	X
30	40	6.5	TRK300300	X	
32	42	4	TRK000320	X	

Radial Oil Seal



Dimension			TSS Part No.	TSS	
d ₁	d ₂	b		NBR	FKM
32	45	6.5	TRK200320	X	
33	40	3	TRK100330	X	
33	40	4	TRK000330	X	
35	41	4	TRK000350	X	X
35	42	4	TRK100350	X	
35	45	4	TRK200350	X	
38	48	4	TRK000380	X	
40	47	4	TRK000400	X	
40	50	4	TRK200400	X	
40	56	8.5	TRK400400	X	
42	52	4	TRK000420	X	
45	52	4	TRK000450	X	
45	55	4	TRK100450	X	
45	62	8	TRKB00450	X	
48	58	4	TRK000480	X	
50	58	4	TRK000500	X	X
50	60	6	TRK100500	X	
50	62	5	TRK200500	X	
50	68	8.5	TRK300500	X	
55	63	5	TRK000550	X	
55	73	8.5	TRK100550	X	
60	72	4	TRK000600	X	
70	78	5	TRK000700	X	X
75	95	7	TRK000750	X	



■ Trelleborg Sealing Solutions type TRG

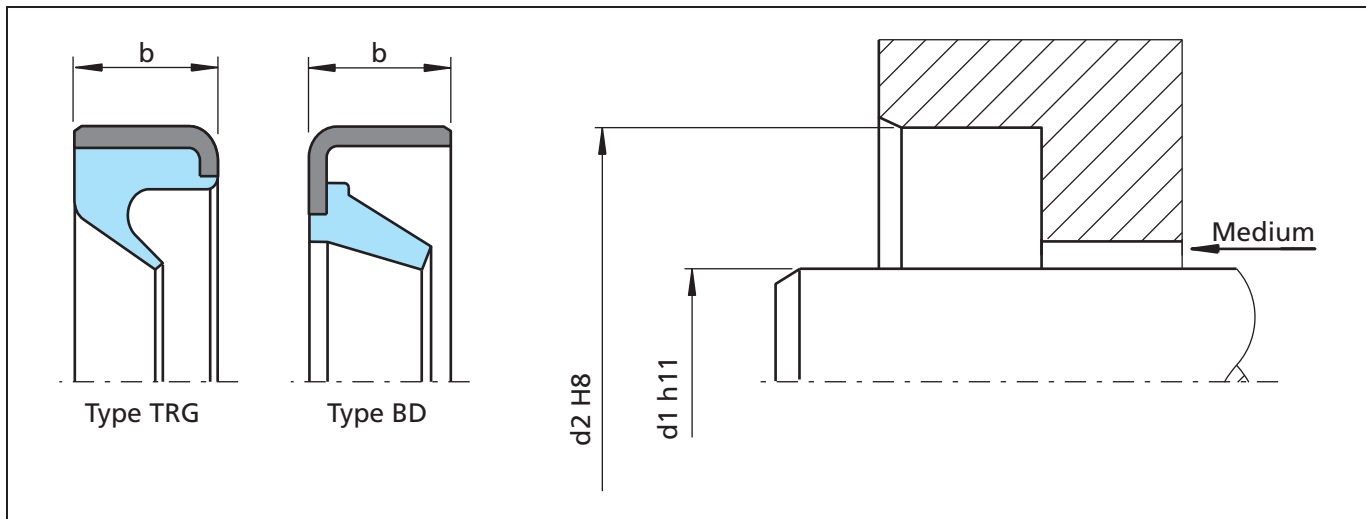


Figure 26 Installation drawing

General description

The Trelleborg Sealing Solutions type TRG and STEFA type BD are special metal cased radial oil seals without spring energized sealing lip. These types are not recommended for use in heavily polluted environments. As the static sealing between housing and metallic shell is limited, low viscosity media can "creep". Better performance can be achieved with Epoxy based resin O.D. coating. This special treatment is on request.

Advantages

- Good radial stiffness
- Good fitting stability avoiding pop-out of the seal
- Low friction and low heat generation
- Extremely compact design
- Low radial force provides a low break-out torque
- Suitable for scraper applications

Application examples

- Roller bearings
- Tooling fixtures (e.g. drilling machines)
- Sealing against viscous media (e.g. grease)
- Supplementary excluders (shaft ends)
- Axle King Pin seals

Technical data

Pressure:	without pressure
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 10 m/s
Media:	mineral and synthetic base greases

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Table XXVII Materials

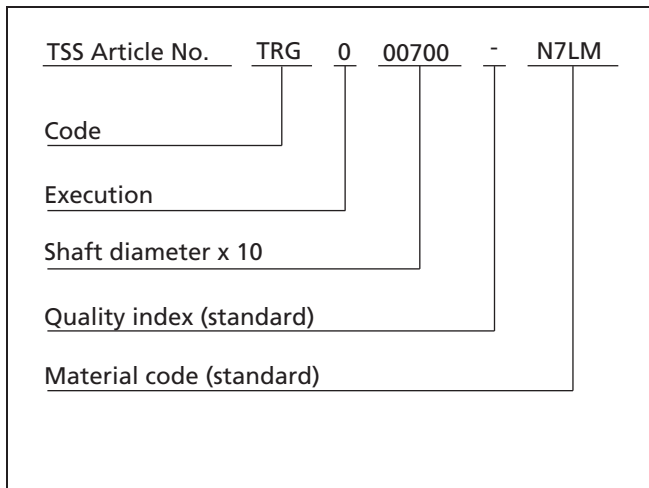
Standard material*	TSS material code	STEFA material reference	Standard metal insert**
NBR (70 Shore A)	N7LM	-	Carbon steel
NBR (75 Shore A)	4N01	1452	
FKM (75 Shore A)	VCBM	-	Carbon steel
FKM (75 Shore A)	4V01	5466	

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert can be supplied in different materials on request.

Ordering example oil seal TSS type

TSS type: G
 Code: TRG
 Dimensions: Shaft diameter 70 mm
 Housing diameter 78 mm
 Width 5 mm
 Material: NBR
 Material Code: N7LM



Ordering example oil seal STEFA type

STEFA type: BD
 Code: TRG
 Dimensions: Shaft diameter 70 mm
 Housing diameter 78 mm
 Width 5 mm
 Material: NBR 1452
 Material Code: 4N01

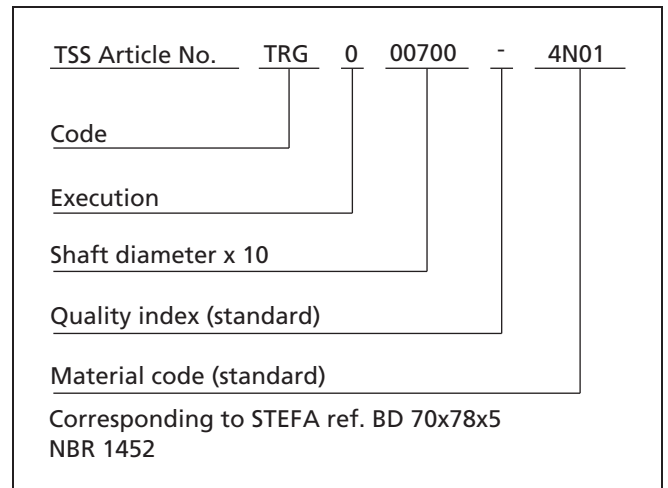


Table XXVIII Preferred series / Dimension, TSS part numbers

Dimension			TSS Part No.	STEFA			TSS	
d ₁	d ₂	b		Type	NBR 4N01	FKM 4V01	NBR N7LM	FKM VCBM
3	8	2	TRG000030				X	
4	8	2	TRG000040				X	X
5	9	2	TRG000050				X	
6	10	2	TRG000060				X	X
6	12	2	TRG100060				X	
7	11	2	TRG000070				X	X

() values in brackets are inch sizes.



Radial Oil Seal

Dimension			TSS Part No.	STEFA			TSS	
d ₁	d ₂	b		Type	NBR 4N01	FKM 4V01	NBR N7LM	FKM VCBM
8	14	2	TRG100080				X	
8	15	3	TRG200080				X	
9	13	3	TRG000090				X	
10	14	3	TRG000100				X	
10	15	3	TRG200100	BD	X			
10	16	4	TRG300100	BD	X	X		
10	17	3	TRG100100				X	
12	16	3	TRG000120				X	X
12	18	3	TRG100120				X	X
12	19	3	TRG200120				X	
14	22	3	TRG200140				X	
15	21	3	TRG000150				X	
15	23	3	TRG100150				X	
16	24	3	TRG200160				X	
17	23	3	TRG000170				X	
18	24	3	TRG000180				X	X
20	26	4	TRG100200				X	
20	28	4	TRG200200				X	X
21	29	4	TRG000210				X	
22	28	4	TRG000220				X	
24	32	4	TRG000240				X	
25	32	4	TRG000250	BD		X	X	X
25	32	5	TRG300250	BD	X			
25	33	4	TRG100250				X	
25	35	4	TRG200250				X	
27	40	10	TRG000270	BD	X			
28	35	6	TRG300280				X	
28	37	4	TRG100280				X	
30	37	4	TRG000300				X	
30	40	4	TRG100300				X	
35	42	4	TRG000350				X	X
35	42	4.46	TRG300350	BD		X		
36	42	4	TRG000360				X	
37	47	4	TRG000370				X	
37	48	4	TRG100370				X	
38	48	4	TRG000380				X	

() values in brackets are inch sizes.

Radial Oil Seal



Dimension			TSS Part No.	STEFA			TSS	
d ₁	d ₂	b		Type	NBR 4N01	FKM 4V01	NBR N7LM	FKM VCBM
38.1	47.1	6.4	TRG000381	BD	X			
39.69 (1.56")	52.48 (2.07")	4.80 (0.19")	TRG000396	BD	X			
40	47	4	TRG000400				X	
40	48	4	TRG100400				X	
40	50	4	TRG200400				X	
40	52	5	TRG300400				X	
40	62	4.76	TRG400400	BD	X			
42	52	4	TRG000420				X	
43	53	4	TRG000430				X	
44	54	5	TRG000440	BD	X			
45	52	4	TRG000450				X	
45	55	4	TRG100450				X	X
50	58	4	TRG000500				X	
52	68	6	TRG000520	BD	X			
55	63	5	TRG000550				X	X
61.6	74	5	TRG000616	BD	X			
67	75.5	4.3	TRG000670	BD	X			
70	78	5	TRG000700	BD	X		X	
77	85.5	4.8	TRG000770	BD	X			

() values in brackets are inch sizes.



■ Rotary and axial seal combination

General Description

In many applications rotary shaft lip seals are used to seal against various media.

Lip seals often fail because of the destruction of the lubricant film, resulting in rapid wear, due to the ingress of dirt, dust, moisture etc. The use of shaft seals with one or more auxiliary sealing lips (dust lips) provides a limited improvement, but it is not always sufficient. In order to meet the constantly increasing sealing requirements, especially for the environmental protection and long service life the Trelleborg Sealing Solutions COMBI-seal is a simple solution. It has proved to be particularly well suited even in critical applications with heavy contamination. The COMBI-seal consists of a GAMMA seal and a rotary shaft lip seal working together. The lip seal provides the counterface for the GAMMA seal which is fixed to the shaft by press fit. See Figure 27 and 28.

Years of successful experiences show that another frequently used alternative consists in the combination of a V-Ring seal with a standard seal selected inside the type list: TRC; TRD; TRB; TRF.

The rotary shaft seal should be ordered **“Without Markings”** on the air side.

Radial Oil Seal + GAMMA seal

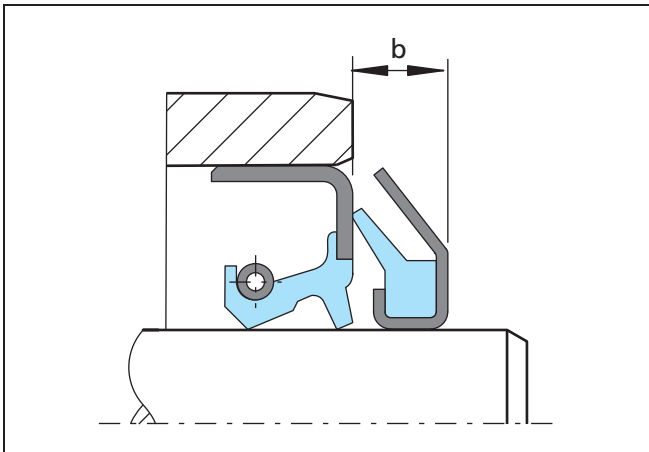


Figure 27 GAMMA seal fitted on the shaft end

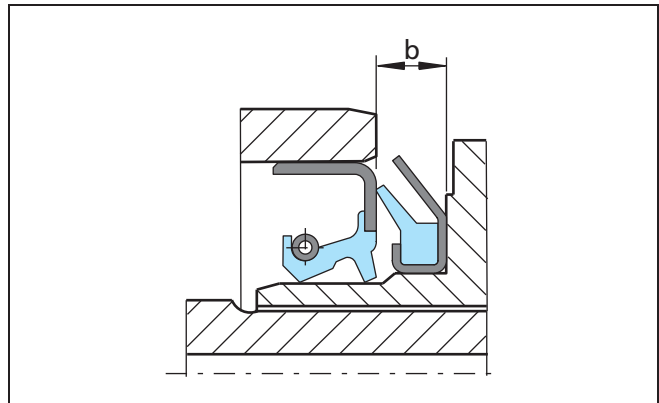


Figure 28 GAMMA seal fitted on the shaft boss

Radial Oil Seal + V-Ring

The function of the rotary axial seal is to prevent by centrifugation the intrusion of particles and water drops.

In other words, it adds its original protection capacity to the radial seal functionality. Sufficient space is required on the shaft to host the axial seal width. (See Figure 29).

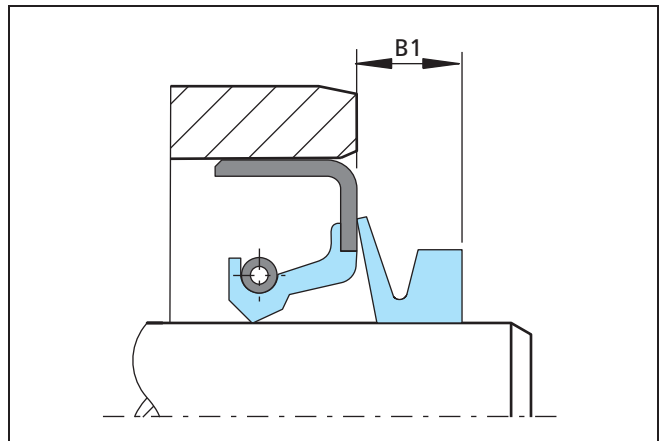


Figure 29 V-Ring fitted on the shaft end

Housing and shaft design

The radial lip seal needs to be assembled in the housing according to usual fitting instructions. Both V-Ring and GAMMA seal is assembled later on the shaft. The shaft design requires to be adapted by an elongation corresponding at least to B1 (b) dimension. In case of very high peripheral speeds, the V-Ring body should be radially supported. See also the instructions reported in the specific catalog chapter.



The GAMMA seal can be fitted according above sequence but sometimes the shaft surface must be slightly changed in order to avoid scratches at assembly that can negatively influence the radial seal functionality (See Figure 27 and 28). See also the instructions in specific catalog chapters.

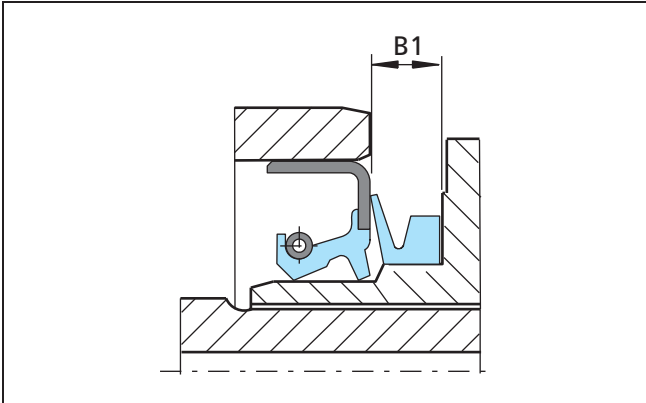


Figure 30 V-Ring type A fitted on the shaft boss

In the examples the V-Ring “type A” is represented, but any other type of V-Ring is usable in accordance with space available and application requirements.

In special application conditions, with design alterations in the housing, it is also possible the use of TRB type (labyrinth formed by metal shell and housing).



Radial Oil Seal

■ Product description

The combination of Radial shaft seal with V-Ring or GAMMA seals is recommended for use in heavily polluted environments.

Both the radial shaft seal and the GAMMA seal housing may also be manufactured with different metal shell as well as different rubber types for sealing elements. See specific paragraphs.

Advantages

- Longer service life and high function reliability
- Good IP protection for electrical motors (VDE-Norm 0470-1)
- Good protection against water splash and welding sparks
- Simple handling
- Superior total economy
- Friction loss decreases with increasing shaft speed

Application examples

Typical applications are all equipment working in contaminated environments where dust, foreign matter and liquid splatter are present.

Some examples:

- gear motors
- journal and gear transmissions
- bearing housings
- power saws
- utility vehicles
- agricultural machinery and equipment
- wheel hubs
- propeller shafts
- pumps
- hydraulic motors
- tool machinery
- equipment for steel manufacturing
- metal working machinery

Technical data

Pressure:	see radial seal data
Temperature:	-40 °C to +200 °C (depending on material)
Speed:	up to 20 m/s (depending on material)
Mediums:	Mineral and synthetic oils (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.

Materials

See specific chapters.

Ordering example

Order components separately as per specific chapters. Order the radial oil seals "**without marking**".



■ Combined rotary shaft seal

General description

The combined rotary shaft lip seal is an assembly which includes a supplementary protection of the radial sealing elements with an axial rotary sealing lip integrated into a wear sleeve. The rubberized wear sleeve and radial seal are designed to satisfy both customer's and DIN 3760 (3761) specifications.

Sealing lips design

The sealing lip's design corresponds to the latest state of development based on many years of laboratory and field tests. The main radial sealing edge can either be ready molded (when equipped with TURBO ribs) or trimmed by mechanical cutting. The total radial force of the sealing lip is extremely low thanks to the miniaturization of the lip profile and the application of smallest possible Garter spring. The above miniaturization is made in order to reduce as much as possible the metal sleeve wear, the friction loss and relevant heat generation.

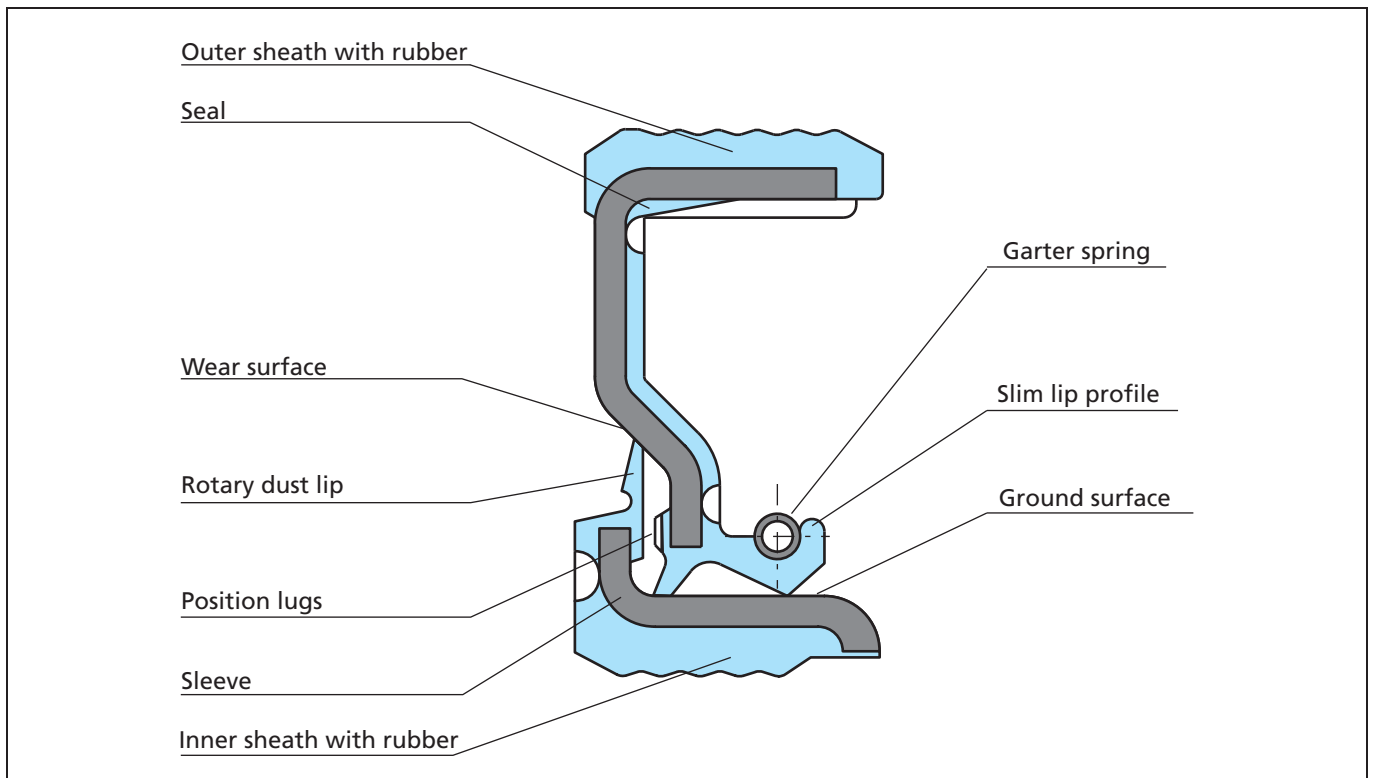


Figure 31 APJ seal details



■ STEFA standard APJ type

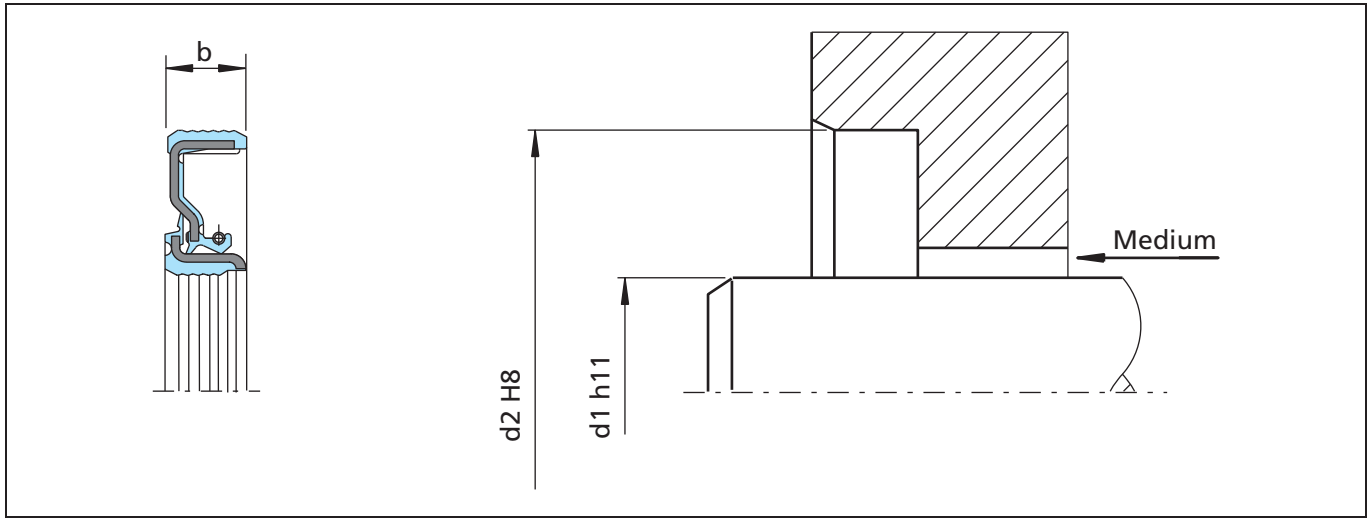


Figure 32 Installation drawing

Product description

STEFA standard APJ is a seal with completely rubber covered outer diameter. Two different O.D designs are available: Flat rubber sheath as well as wavy, both correctly fitting into H8 bores.

APJ seal is recommended for use in heavily polluted environments.

Both the seal and the sleeve may also be manufactured with different metal insert material as well as different rubber types.

Advantages

- Good static sealing
- Compensation of different thermal expansion
- No risk of fretting corrosion
- Higher bore surface roughness is allowed
- Do not require shaft hardening
- Do not require shaft grinding
- Modern lip design provides low power loss

Application examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Washing machines
- Machinery for Industry (e.g. tool machines)
- Axles for heavy-duty applications

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40 °C to +200 °C (depending on material)
Speed:	up to 10 m/s (depending on material)
Media:	mineral and synthetic oils (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Table XIX Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (75 Shore A)	4N011	Carbon steel	Carbon steel
FKM (75 Shore A)	4V012	Carbon steel	Stainless steel

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Remark: These seals are customer tailored products.

For more details please contact your local Trelleborg Sealing Solutions marketing company.



Radial Oil Seal

■ STEFA 1B/APJ and 2B/APJ types - housing as per DIN 3760-3761

The design of the radial seal corresponds to STEFA Type 1B/CC and 2B/CC.

The sleeve remains the same for all kind of radial seal design.

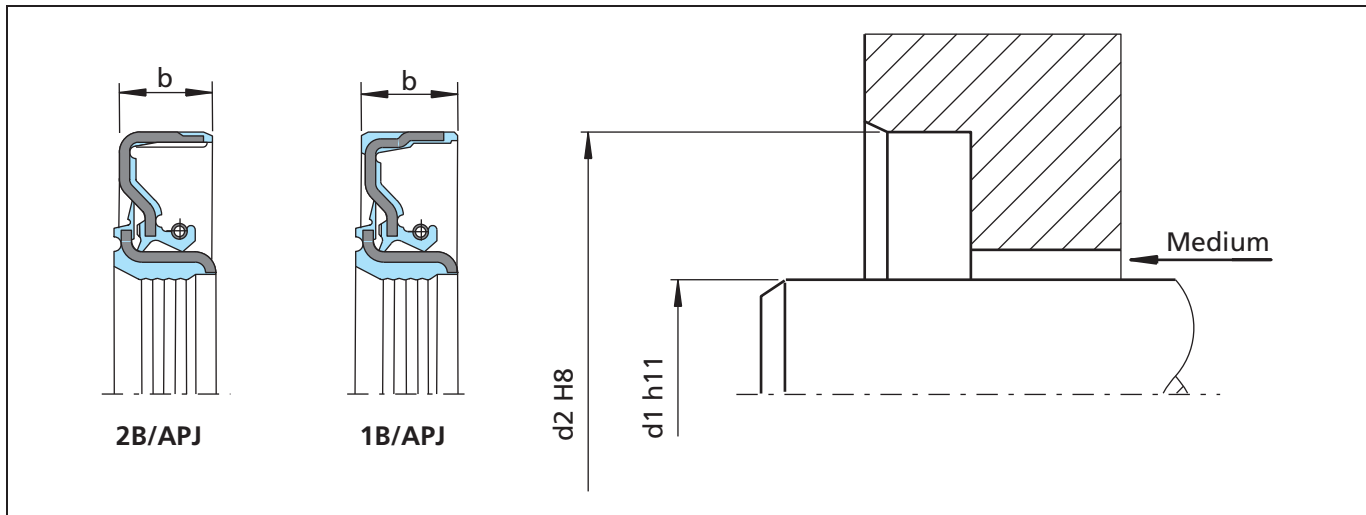


Figure 33 Installation drawing

Product description

STEFA 1B/APJ and 2B/APJ types are radial lip seals with partially rubber covered outer diameter.

1B/APJ type recommended for use in heavily polluted environments and where a good axial retention force is required with a good heat transfer as well. The type 2B/APJ is recommended for aluminum or soft metal housings that may be scratched at assembly by metal frame of the seal.

Advantages

- Good static sealing
- Compensation of different thermal expansion
- Higher bore surface roughness is allowed
- Do not require shaft treatment (hardening and grinding)
- Modern lip design provides low power loss
- Good heat transfer to outside
- Quick servicing (No shaft rework required)

Applications examples

- Transmission systems (e.g. gearboxes)
- Pumps
- Machinery industry (e.g. Machine tools, weaving machinery)
- Axle Hubs and axles for heavy-duty applications

Technical data

Pressure:	up to 0.05 MPa
Temperature:	-40°C to +200°C (depending on material)
Speed:	up to 10 m/s (depending on material)
Media:	mineral and synthetic oils (CLP, HLP, APGL etc.)

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask for details.

Important Note:

The above data are maximum values and cannot be used at the same time, e. g. the maximum operating speed depends on material type, pressure and temperature.



Table XXX Materials

Standard material*	TSS material code	Standard metal insert**	Standard spring**
NBR (75 Shore A)	4N011	Carbon steel	Carbon steel
FKM (75 Shore A)	4V012	Carbon steel	Stainless steel

* Special grades and other materials (ACM, EACM, EPDM, HNBR, VMQ) on request.

** Metal insert, and spring as well, can be supplied in different materials on request.

Remark: These seals are customer tailored products.

For more details please contact your local Trelleborg Sealing Solutions marketing company.



■ Trelleborg Sealing Solutions type TRJ/TRL

Fiber reinforced oil seals for large diameter

Fiber reinforced oil seals contain no metal parts with the exception of the spring. Instead of the metal insert, a reinforced fiber component is molded into the body of the seal. Damage through transport and mounting is consequently excluded.

Fiber reinforced oil seals are mainly used for installation in constructions and equipment with large diameters.

The use of an axial retaining plate is necessary except for the type TRJ/F and respectively for the type TRL/F.

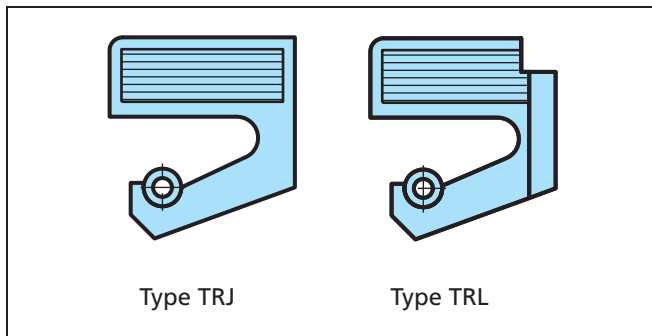


Figure 34 Fibers reinforced design for large diameters

Split version

To ease the mounting or in case of repair the types TRJ and TRL are also available in split version.

To ensure effective sealing at the split ends, a full rubber section is molded at the joint so that contact between homogeneous elastic surfaces maximizes the sealing effect.

The interface should always be above the oil level.

If two seals in split version are mounted together, the interface should be turned a minimum of 30° to the side.

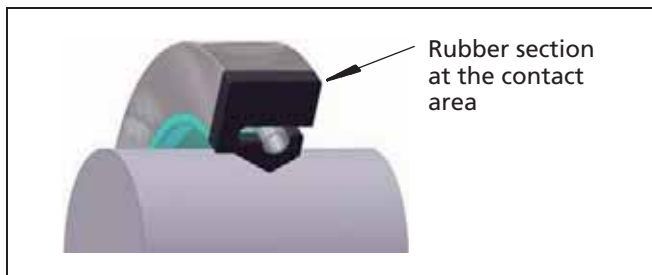


Figure 35 Contact area, split seal

Separation of two media with type TRL

A single oil seal should not be used for the separation of two Media.

In such cases two seals are fitted in a back to back arrangement. The type TRL is suitable for the sealing of large diameters. It is a special design with peripheral and radial grooves where a lubricant could be applied.

The peripheral groove on the seal reduces the need to cut a groove in the housing. See figure : Type TRL mounted back to back.

The seal can used for:

- Isolation of two media
- If a lubrication is necessary from the outside

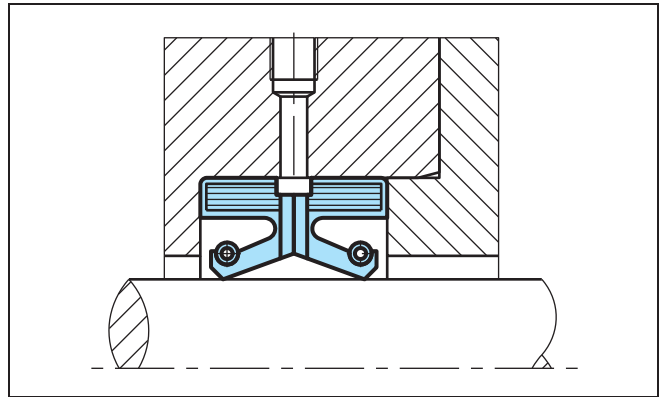


Figure 36 Type TRL mounted back to back

Special design TRJ/F and TRL/F with reinforced shoulder

Whenever a retaining plate cannot be fitted we can supply a seal made in a special hardened compound namely type TRJ/F and TRL/L, which makes the seal self-retaining and providing effective sealing also at the O.D.

Trelleborg Sealing Solutions type TRJ/F and TRL/F are supplied in standard form and are not available in split version. See figure 37.

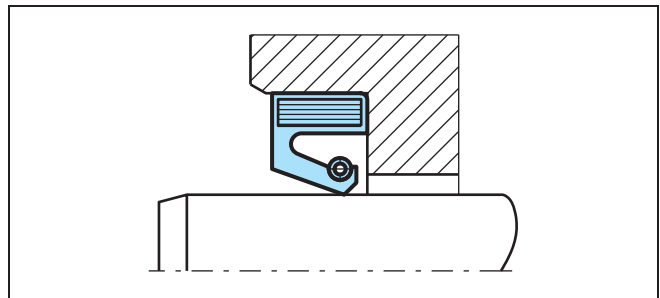


Figure 37 Type TRJ/F mounted without axial retaining plate



Design Instructions

Installation on the shaft

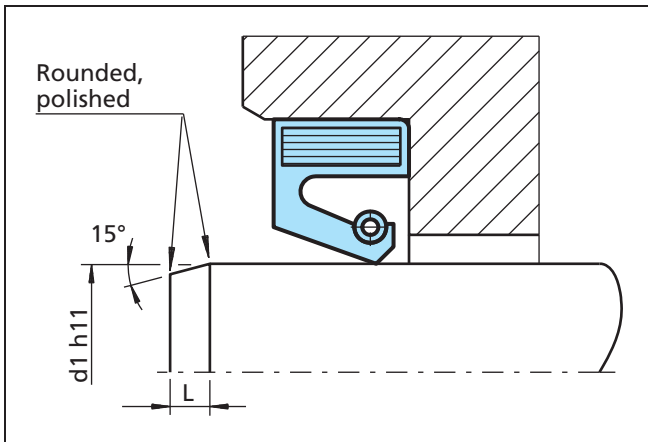


Figure 38 Installation of the oil seal

To facilitate the installation of the seal with minimum risk of lip damage, the shaft have a 15° chamfer with length "L" as function of its diameter "d1".

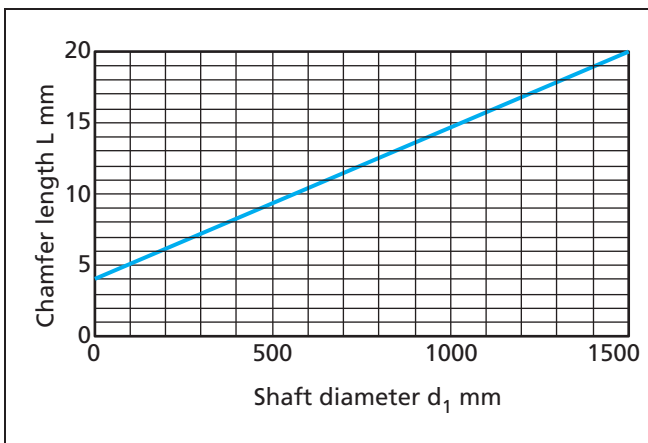


Figure 39 Chamfer length as function of the shaft diameter

Eccentricity

Eccentricity between shaft and housing bore centers should be avoided in order to eliminate unilateral load of the lip.

Table XXXI Static Eccentricity

d ₁	b x f (mm)	max. stat. Ecc. (mm)
100 - 250	16 x 20	0.50
250 - 400	20 x 22	0.55
400 - 600	22 x 25	0.62
>600	25 x 32	0.70

Shaft run out

Shaft run out should be avoided or kept within a minimum. At higher speeds there is a risk that the inertia of the sealing lip prevents it from following the shaft movement. The seal must be located next to the bearing and the bearing play be maintained at the minimum value possible.

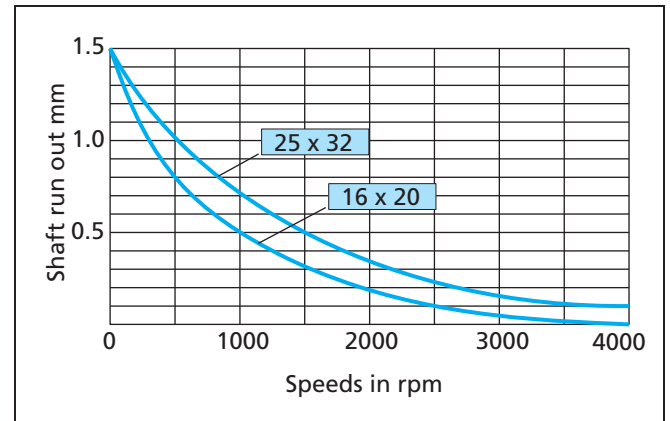


Figure 40 Shaft run out

Installation in the gland

The static seal in the mounting bore is provided by the corresponding force fit allowance at the outer sheath of the seal.

The bore tolerance is specified to DIN ISO 286T2-H8.

Values for the surface roughness in the gland are specified in ISO 6194/1.

General values:	Ra	= 1.6 - 6.3 μm
	Rz	= 10 - 20 μm
	Rmax.	= 16 - 25 μm

For gas sealing, a good score-free and spiral-free surface finish is necessary. If the rotary shaft lip seal is bonded into the housing, ensure that no adhesive comes into contact with the sealing lip or the shaft.

The bore d₂ of the sealing housing indicated in table XXXI as function of shaft diameter. (d₂= d₁+2 x f). See page116.

The width(b) including the tolerance is also given in table XXXII.



Radial Oil Seal

■ Installation, Type TRJ

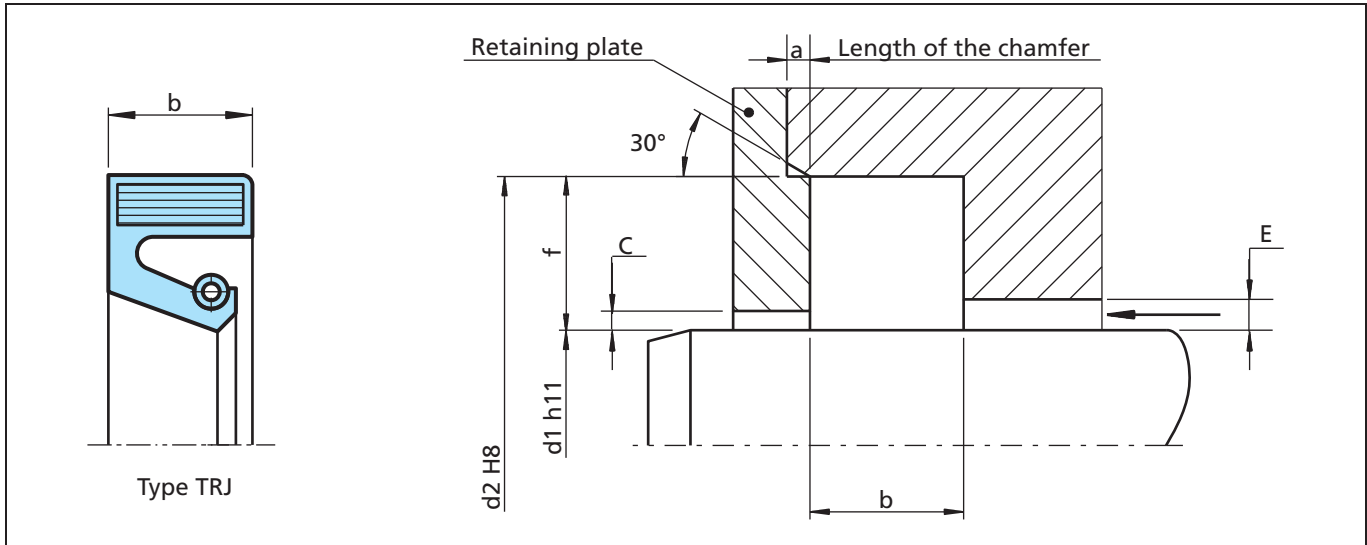


Figure 41 Installation drawing

■ Installation, Type TRL

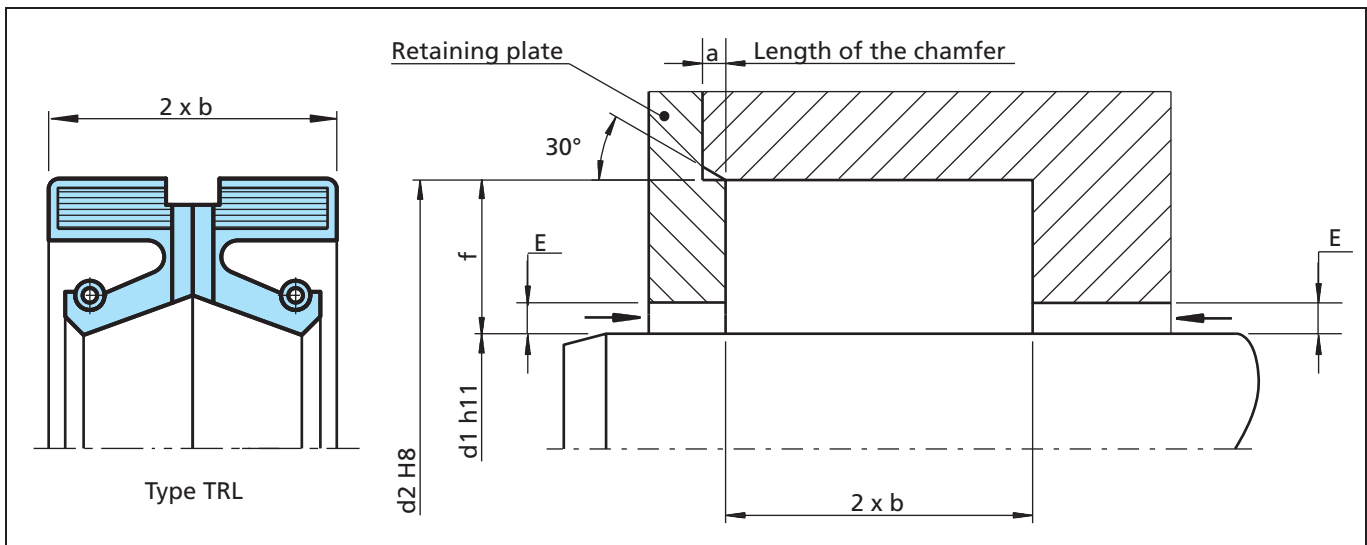


Figure 42 Installation drawing

Table XXXII Dimensions

d1	b x f	a	E	C	b
100 - 250	16 x 20	2.0	9	4	16 ±0.1
250 - 400	20 x 22	2.2	11	6	20 ±0.2
400 - 600	22 x 25	2.5	11	7	22 ±0.2
>600	25 x 32	3.2	14	8	25 ±0.2



■ Technical Data, Type TRJ and TRL*

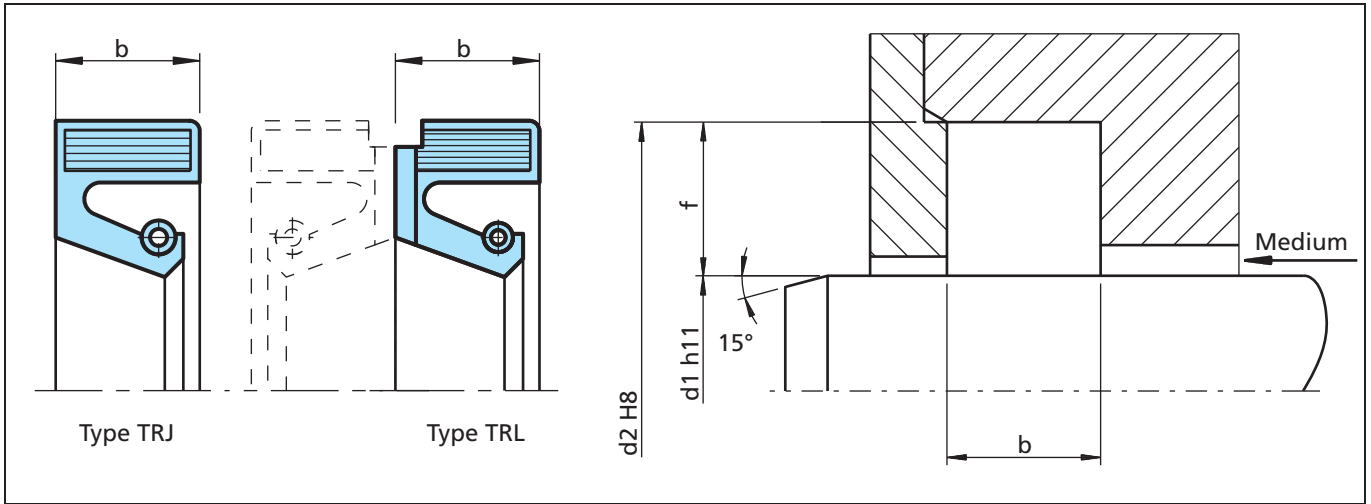


Figure 43 Installation drawing

Table XXXIII Material

Standard-material*	TSS Material code	Standard-spring*
NBR (75 Shore A)	4NC01	Carbon steel
HNBR (75 Shore A)	4HC01	Carbon steel
FKM (75 Shore A)	4VC02	Stainless steel

* The spring can be supplied in different materials on request.

Table XXXIV Technical Data

Type	Temperature	Speed	Pressure	Dimensions
TRJ	-30°C to +200°C	up to 25 m/s	0.05 MPa	100 - 1890
TRL	-30°C to +200°C	up to 25 m/s	0.05 MPa	100 - 1890

Ordering example

TSS Code: TRJ
 Dimensions: Shaft diameter: 100 mm
 Housing diameter: 115 mm
 Width: 8.9 mm
 Material: NBR
 Material-Code: 4NC01

TSS Article No.	TRJ	100x115x8,9	4NC01
TSS Code			
Dimension			
Material			



Radial Oil Seal

Table XXXV Dimensions for Type TRJ/TRL

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
100.0	115.0	8.9	7.5	X	○
100.0	115.0	9.0	7.5	X	○
100.0	120.0	13.0	10.0	X	○
100.0	125.0	13.0	12.5	X	○
100.0	125.0	15.0	12.5	X	○
100.0	125.4	12.7	12.7	X	X
100.0	130.0	12.0	15.0	X	○
100.0	130.0	15.0	15.0	X	○
100.0	132.0	12.5	16.0	X	X
100.0	140.0	16.0	20.0	X	○
105.0	129.0	13.0	12.0	X	○
105.0	130.0	12.0	12.5	X	○
105.0	130.0	13.0	12.5	X	○
105.0	133.5	12.7	14.3	X	○
105.0	137.0	16.0	16.0	X	○
105.0	140.0	12.0	17.5	X	○
105.0	143.0	16.0	19.0	X	○
105.0	145.0	16.0	20.0	X	○
110.0	126.0	9.0	8.0	X	○
110.0	126.0	12.0	8.0	X	○
110.0	130.0	9.0	10.0	X	○
110.0	130.0	12.0	10.0	X	○
110.0	130.0	13.0	10.0	X	○
110.0	135.0	12.0	12.5	X	○
110.0	140.0	12.0	15.0	X	○
110.0	140.0	14.0	15.0	X	○
110.0	140.0	15.0	15.0	X	○
110.0	140.0	16.0	15.0	X	○
110.0	141.0	13.7	15.5	X	○
110.0	145.0	19.0	17.5	X	○
110.0	150.0	16.0	20.0	X	○
115.0	137.0	8.8	11.0	X	○
115.0	137.0	9.0	11.0		X
115.0	140.0	12.0	12.5	X	○
115.0	140.0	13.0	12.5	X	X
115.0	140.4	9.5	12.7	X	○
115.0	145.0	12.0	15.0	X	○
115.0	145.0	15.0	15.0	X	○
115.0	150.0	15.0	17.5	X	○

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
115.0	155.0	16.0	20.0	X	○
118.0	140.0	14.0	11.0	X	○
120.0	140.0	12.5	10.0	X	○
120.0	140.0	13.0	10.0	X	○
120.0	140.0	14.5	10.0	X	○
120.0	144.0	15.5	12.0	X	○
120.0	145.0	15.5	12.5	X	○
120.0	150.0	13.0	15.0	X	○
120.0	150.0	15.0	15.0	X	○
120.0	150.0	16.0	15.0	X	○
120.0	152.0	16.0	16.0	X	○
120.0	160.0	12.0	20.0	X	○
120.0	160.0	16.0	20.0	X	X
120.0	170.0	15.0	25.0	X	○
125.0	140.0	10.0	7.5	X	○
125.0	150.0	12.0	12.5	X	○
125.0	150.0	15.0	12.5	X	○
125.0	153.5	12.7	14.2	X	○
125.0	155.0	12.0	15.0	X	○
125.0	160.0	12.0	17.5	X	○
125.0	160.0	13.0	17.5	X	○
125.0	160.0	15.0	17.5	X	○
125.0	165.0	15.0	20.0	X	○
125.0	165.0	16.0	20.0	X	○
127.0	157.0	15.0	15.0	X	○
128.0	165.0	15.0	18.5	X	○
130.0	150.0	10.0	10.0	X	○
130.0	150.0	12.0	10.0	X	○
130.0	155.0	10.0	12.5	X	○
130.0	155.0	15.5	12.5	X	○
130.0	160.0	12.0	15.0	X	○
130.0	160.0	15.0	15.0	X	○
130.0	160.0	16.0	15.0	X	○
130.0	165.0	13.0	17.5	X	○
130.0	170.0	13.0	20.0	X	○
130.0	170.0	16.0	20.0	X	○
133.0	165.0	12.5	16.0		X
134.0	169.0	15.0	17.5	X	○
135.0	157.0	8.0	11.0	X	○

"X" Tools available.

"○" As special part available on request.

Dimensions printed in **bold** are preferred sizes. Further sizes on request.

Radial Oil Seal



Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
135.0	160.0	12.0	12.5	X	○
135.0	165.0	13.0	15.0	X	○
135.0	167.0	15.0	16.0	X	○
135.0	170.0	12.0	17.5	X	○
135.0	170.0	13.0	17.5	X	○
135.0	170.0	16.5	17.5	X	○
135.0	175.0	16.0	20.0	X	○
136.0	160.0	10.0	12.0	X	○
138.0	180.0	15.0	21.0	X	○
139.0	155.0	10.0	8.0	X	○
139.0	169.0	14.6	15.0	X	○
140.0	155.0	10.0	7.5	X	○
140.0	160.0	13.0	10.0	X	○
140.0	165.0	15.0	12.5	X	○
140.0	168.0	21.0	14.0	X	○
140.0	170.0	15.0	15.0	X	○
140.0	180.0	12.0	20.0	X	○
140.0	180.0	15.0	20.0	X	○
140.0	180.0	16.0	20.0	X	X
140.0	190.0	15.0	25.0	X	○
143.0	165.0	10.0	11.0	X	○
144.0	180.0	15.0	18.0	X	○
145.0	170.0	13.0	12.5	X	○
145.0	170.0	15.0	12.5	X	○
145.0	180.0	12.0	17.5	X	○
145.0	180.0	14.0	17.5	X	○
149.0	179.0	13.0	15.0	X	○
149.0	180.0	16.0	15.5	X	○
150.0	172.0	12.7	11.0	X	○
150.0	180.0	12.0	15.0	X	X
150.0	180.0	13.0	15.0	X	○
150.0	180.0	14.0	15.0	X	○
150.0	180.0	15.0	15.0	X	○
150.0	185.0	15.0	17.5	X	○
150.0	188.0	16.0	19.0	X	○
150.0	190.0	16.0	20.0	X	X
150.0	190.0	20.0	20.0	X	○
152.0	180.0	14.0	14.0	X	○
152.0	190.0	19.0	19.0	X	○

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
154.0	180.0	12.2	13.0	X	○
155.0	175.0	10.8	10.0	X	○
155.0	180.0	12.5	12.5	X	○
155.0	180.0	15.0	12.5	X	○
155.0	190.0	13.0	17.5	X	○
156.0	195.0	15.0	19.5		X
159.0	200.0	16.0	20.5	X	○
160.0	188.0	21.0	14.0	X	○
160.0	190.0	15.0	15.0	X	○
160.0	190.0	16.0	15.0	X	○
160.0	200.0	16.0	20.0	X	X
165.0	190.0	15.0	12.5	X	○
165.0	195.0	15.0	15.0	X	X
165.0	200.0	15.0	17.5	X	○
165.0	203.0	19.0	19.0	X	○
165.0	205.0	16.0	20.0	X	○
168.0	200.0	16.0	16.0	X	○
169.0	200.0	12.0	15.5	X	○
169.0	201.0	12.5	16.0	X	○
170.0	192.0	10.7	11.0	X	○
170.0	195.0	14.2	12.5	X	○
170.0	200.0	12.0	15.0	X	X
170.0	200.0	15.0	15.0	X	○
170.0	205.0	18.0	17.5	X	○
170.0	210.0	16.0	20.0	X	X
170.0	220.0	15.0	25.0	X	○
170.0	223.0	20.0	26.5	X	○
174.0	214.0	16.0	20.0	X	○
175.0	200.0	15.0	12.7	X	○
175.0	205.0	15.0	15.0	X	X
175.0	215.0	15.0	20.0	X	○
175.0	215.0	16.0	20.0	X	○
180.0	200.0	15.0	10.0	X	○
180.0	205.0	12.5	12.5	X	○
180.0	210.0	12.0	15.0	X	○
180.0	210.0	15.0	15.0	X	X
180.0	212.0	16.0	16.0	X	○
180.0	215.0	15.0	17.5	X	○
180.0	216.0	21.8	18.0	X	○

"X" Tools available.

"○" As special part available on request.

Dimensions printed in **bold** are preferred sizes. Further sizes on request.



Radial Oil Seal

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
180.0	220.0	13.0	20.0	X	○
180.0	220.0	16.0	20.0	X	X
180.0	230.0	16.0	25.0	X	○
182.0	215.0	16.0	16.5	X	○
185.0	210.0	13.0	12.5	X	○
185.0	215.0	15.0	15.0		X
185.0	215.0	16.0	15.0	X	○
185.0	220.0	16.0	17.5	X	○
185.0	225.0	16.0	20.0	X	X
185.0	230.0	16.0	22.5	X	○
190.0	210.0	15.0	10.0	X	○
190.0	212.0	11.7	11.0	X	○
190.0	215.0	16.0	12.5	X	○
190.0	220.0	15.0	15.0	X	X
190.0	220.0	16.0	15.0	X	○
190.0	225.0	18.0	17.5	X	○
190.0	230.0	15.0	20.0	X	○
190.0	230.0	16.0	20.0	X	X
195.0	220.0	15.0	12.5	X	○
195.0	230.0	15.0	17.5	X	○
195.0	230.0	16.0	17.5	X	○
195.0	235.0	16.0	20.0	X	○
196.0	228.0	16.0	16.0	X	○
196.0	235.0	19.0	19.5	X	○
200.0	225.0	15.0	12.5	X	○
200.0	230.0	15.0	15.0	X	X
200.0	230.0	16.0	15.0	X	○
200.0	235.0	18.2	17.5	X	○
200.0	240.0	15.0	20.0	X	○
200.0	240.0	16.0	20.0	X	X
200.0	250.0	15.0	25.0	X	○
200.0	250.0	18.0	25.0	X	○
205.0	230.0	16.0	12.5	X	○
205.0	245.0	16.0	20.0	X	○
205.0	245.0	20.0	20.0	X	○
205.0	250.0	16.0	22.5	X	○
210.0	240.0	13.0	15.0	X	○
210.0	245.0	15.0	17.5	X	○
210.0	245.0	18.0	17.5	X	○

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
210.0	246.0	16.0	18.0	X	○
210.0	250.0	15.0	20.0	X	○
210.0	250.0	16.0	20.0	X	X
210.0	274.0	26.0	32.0	X	○
213.0	248.0	16.0	17.5	X	○
215.0	240.0	12.0	12.5	X	○
215.0	245.0	16.0	15.0	X	X
215.0	247.0	12.5	16.0	X	○
215.0	248.0	15.0	16.5	X	○
215.0	251.0	12.5	18.0	X	○
215.0	265.0	17.0	25.0	X	○
216.0	241.5	12.7	12.7	X	○
216.0	254.0	16.0	19.0	X	○
216.0	254.0	19.0	19.0	X	○
216.9	254.0	19.0	18.5	X	○
218.0	245.0	12.5	13.5	X	○
218.0	270.0	22.0	26.0	X	○
220.0	245.0	12.5	12.5		X
220.0	250.0	12.0	15.0	X	○
220.0	250.0	15.0	15.0	X	X
220.0	250.0	16.0	15.0	X	○
220.0	250.0	19.0	15.0	X	○
220.0	254.0	16.0	17.0	X	○
220.0	255.0	16.0	17.5	X	○
220.0	255.0	18.0	17.5	X	○
220.0	258.0	25.4	19.0	X	○
220.0	260.0	15.0	20.0	X	○
220.0	260.0	16.0	20.0	X	X
220.0	260.0	20.0	20.0	X	○
220.0	260.0	22.0	20.0	X	○
220.0	270.0	16.0	25.0	X	○
225.0	250.0	12.5	12.5	X	○
225.0	260.0	16.0	17.5	X	○
225.0	270.0	16.0	22.5	X	○
226.0	258.0	16.0	16.0	X	○
228.0	268.0	16.0	20.0		X
228.0	268.0	20.0	20.0	X	○
230.0	255.0	10.0	12.5	X	○
230.0	255.0	11.7	12.5	X	○

"X" Tools available.

"○" As special part available on request.

Dimensions printed in **bold** are preferred sizes. Further sizes on request.

Radial Oil Seal



Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
230.0	255.0	15.0	12.5	X	○
230.0	260.0	12.5	15.0	X	○
230.0	260.0	15.0	15.0	X	○
230.0	260.0	16.0	15.0	X	○
230.0	265.0	18.0	17.5	X	○
230.0	270.0	16.0	20.0	X	X
230.0	280.0	15.0	25.0	X	○
230.0	280.0	23.0	25.0		X
230.0	285.0	23.0	27.5	X	○
234.9	273.0	19.0	19.1	X	○
235.0	270.0	16.0	17.5	X	○
235.0	270.0	18.0	17.5	X	○
235.0	275.0	20.0	17.5	X	○
236.0	276.0	16.0	20.0		X
240.0	270.0	15.0	15.0	X	○
240.0	270.0	17.0	15.0	X	○
240.0	275.0	18.0	20.0	X	○
240.0	276.0	18.0	18.0	X	○
240.0	278.0	17.0	19.0	X	○
240.0	280.0	16.0	20.0	X	X
240.0	280.0	17.5	20.0	X	○
245.0	270.0	13.0	12.5	X	○
245.0	270.0	16.0	12.5	X	X
250.0	280.0	15.0	15.0	X	○
250.0	280.0	16.0	15.0	X	X
250.0	285.0	18.0	17.5	X	○
250.0	285.0	20.0	17.5	X	○
250.0	288.0	19.0	19.0	X	○
250.0	290.0	16.0	20.0	X	X
250.0	300.0	20.0	25.0	X	○
250.0	303.0	20.0	26.5	X	○
250.0	310.0	25.0	30.0	X	○
253.0	285.0	11.0	16.0	X	○
254.0	279.0	9.3	12.5	X	○
254.0	292.0	15.9	19.0	X	○
255.0	285.0	11.0	15.0	X	X
255.0	285.0	15.0	15.0	X	○
255.0	295.0	16.0	20.0	X	X
255.0	310.0	18.0	27.5	X	○

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
258.0	290.0	16.0	16.0	X	X
260.0	285.0	18.0	12.5	X	○
260.0	290.0	16.0	15.0	X	X
260.0	290.0	19.0	15.0	X	○
260.0	292.0	12.5	16.0	X	○
260.0	298.0	17.0	19.0	X	○
260.0	300.0	18.0	20.0	X	○
260.0	300.0	20.0	20.0	X	○
260.0	304.0	20.0	22.0	X	X
260.0	305.0	16.0	22.5	X	○
260.0	305.0	22.0	22.5	X	○
260.0	310.0	16.0	25.0	X	○
260.0	310.0	18.0	25.0	X	○
264.0	309.0	21.5	22.5	X	○
265.0	300.0	16.0	17.5	X	X
265.0	310.0	16.0	22.5	X	○
265.0	310.0	22.0	22.5	X	○
270.0	300.0	15.0	15.0	X	X
270.0	310.0	16.0	20.0	X	○
270.0	310.0	20.0	20.0	X	○
270.0	314.0	20.0	22.0	X	X
272.0	304.0	16.0	16.0	X	○
272.0	304.0	16.5	16.0	X	○
273.0	317.0	19.0	22.0	X	○
275.0	310.0	15.0	17.5	X	○
277.0	317.0	19.0	20.0	X	○
280.0	310.0	15.0	15.0	X	○
280.0	310.0	16.0	15.0	X	○
280.0	318.0	15.0	19.0	X	○
280.0	320.0	16.0	20.0	X	X
280.0	320.0	18.0	20.0	X	○
280.0	320.0	20.0	20.0	X	○
280.0	324.0	20.0	22.0	X	○
280.0	325.0	24.0	22.5	X	○
285.0	310.0	16.0	12.5	X	○
285.0	325.0	16.0	20.0		X
285.0	325.0	18.0	20.0	X	○
286.0	330.0	16.0	22.0	X	○
290.0	320.0	15.0	15.0	X	○

"X" Tools available.

"○" As special part available on request.

Dimensions printed in **bold** are preferred sizes. Further sizes on request.



Radial Oil Seal

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
290.0	322.0	12.5	16.0	X	○
290.0	330.0	16.0	20.0	X	○
290.0	330.0	18.0	20.0	X	○
290.0	330.0	20.0	20.0	X	○
290.0	334.0	20.0	22.0	X	X
290.0	335.0	20.0	22.5	X	○
290.0	350.0	25.0	30.0	X	○
295.0	325.0	15.0	15.0	X	○
295.0	335.0	15.0	20.0		X
295.0	335.0	16.0	20.0	X	○
295.0	339.0	20.0	22.0	X	○
300.0	330.0	14.0	15.0		X
300.0	332.0	15.0	16.0	X	○
300.0	332.0	16.0	16.0	X	○
300.0	335.0	16.0	17.5	X	○
300.0	335.0	18.0	17.5	X	X
300.0	340.0	16.0	20.0	X	X
300.0	340.0	18.0	20.0	X	X
300.0	340.0	20.0	20.0	X	○
300.0	340.0	25.0	20.0	X	○
300.0	344.0	20.0	22.0	X	X
300.0	344.0	22.0	22.0	X	○
300.0	350.0	22.0	25.0	X	○
300.0	350.0	25.0	25.0	X	○
300.0	360.0	25.0	30.0	X	○
300.0	364.0	25.0	32.0	X	○
300.0	370.0	18.0	35.0	X	○
305.0	340.0	15.0	17.5	X	○
305.0	349.0	20.0	22.0	X	○
305.0	355.0	15.0	25.0	X	○
305.0	362.0	19.0	28.5	X	○
310.0	350.0	17.5	20.0	X	○
310.0	350.0	18.0	20.0	X	X
310.0	354.0	20.0	22.0	X	○
310.0	355.0	24.0	22.5	X	○
310.0	370.0	28.0	30.0	X	○
314.0	355.0	20.0	20.5	X	○
315.0	347.0	13.0	16.0	X	○
315.0	355.0	18.0	20.0	X	○

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
315.0	359.0	20.0	22.0	X	○
315.0	360.0	20.0	22.5		X
315.0	365.0	20.0	25.0	X	○
315.0	380.0	29.0	32.5	X	○
317.0	361.0	20.0	22.0	X	X
320.0	350.0	15.0	15.0	X	○
320.0	355.0	16.0	17.5	X	X
320.0	360.0	18.0	20.0	X	X
320.0	360.0	20.0	20.0	X	X
320.0	364.0	20.0	22.0	X	X
323.0	363.0	16.0	20.0	X	○
325.0	365.0	16.0	20.0	X	X
325.0	365.0	20.0	20.0	X	○
325.0	365.0	22.0	20.0	X	○
325.0	369.0	20.0	22.0	X	○
325.0	375.0	22.0	25.0		X
328.0	372.0	20.2	22.0	X	○
330.0	370.0	18.0	20.0	X	○
330.0	370.0	20.0	20.0	X	X
330.0	374.0	19.0	22.0	X	○
330.0	374.0	20.0	22.0	X	X
330.0	374.0	22.0	22.0	X	○
335.0	375.0	18.0	20.0	X	○
335.0	379.0	20.0	22.0	X	X
335.0	400.0	35.0	32.5	X	○
338.0	382.0	20.0	22.0	X	○
340.0	370.0	15.0	15.0	X	○
340.0	370.0	18.0	15.0	X	○
340.0	370.0	20.0	15.0	X	○
340.0	372.0	16.0	16.0	X	○
340.0	373.0	16.0	16.5	X	○
340.0	378.0	16.0	19.0	X	○
340.0	380.0	18.0	20.0	X	○
340.0	380.0	20.0	20.0	X	○
340.0	384.0	20.0	22.0	X	○
340.0	400.0	28.0	30.0	X	○
345.0	389.0	20.0	22.0	X	○
345.0	395.0	20.0	25.0	X	○
346.0	390.0	20.0	22.0	X	○

"X" Tools available.

"○" As special part available on request.

Dimensions printed in **bold** are preferred sizes. Further sizes on request.

Radial Oil Seal



Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
348.0	380.0	16.0	16.0	X	○
350.0	380.0	16.0	15.0	X	○
350.0	390.0	15.0	20.0	X	○
350.0	390.0	16.0	20.0	X	○
350.0	390.0	18.0	20.0	X	○
350.0	390.0	20.0	20.0	X	X
350.0	394.0	20.0	22.0	X	X
350.0	394.0	22.0	22.0	X	○
350.0	405.0	20.0	27.5	X	○
355.0	379.0	20.0	12.0	X	○
355.0	385.0	16.0	15.0		X
355.0	394.0	20.0	19.5	X	○
355.0	410.0	25.0	27.5		X
360.0	390.0	18.0	15.0	X	○
360.0	400.0	16.0	20.0	X	○
360.0	400.0	18.0	20.0	X	○
360.0	400.0	20.0	20.0	X	○
360.0	404.0	20.0	22.0	X	X
360.0	410.0	22.0	25.0	X	○
362.0	400.0	20.0	19.0	X	○
362.0	406.0	19.5	22.0	X	○
362.0	406.0	20.0	22.0	X	○
362.0	406.0	22.0	22.0	X	○
363.0	418.0	20.0	27.5	X	○
365.0	405.0	18.0	20.0	X	○
365.0	409.0	20.0	22.0	X	X
370.0	410.0	15.0	20.0	X	○
370.0	410.0	18.0	20.0		X
370.0	410.0	20.0	20.0	X	○
370.0	414.0	19.0	22.0	X	X
370.0	414.0	20.0	22.0	X	X
370.0	414.0	25.0	22.0	X	○
375.0	419.0	20.0	22.0	X	○
375.0	419.0	22.2	22.0	X	○
375.0	420.0	16.0	22.5	X	○
378.0	428.0	18.5	25.0	X	○
380.0	410.0	12.5	15.0	X	○
380.0	420.0	15.0	20.0	X	○
380.0	420.0	15.0	20.0		X

Dimensions				Type	
d ₁	d ₂	b	f	TRJ	TRL
380.0	420.0	18.0	20.0	X	X
380.0	420.0	20.0	20.0	X	○
380.0	420.0	20.0	20.0	X	○
380.0	420.0	22.0	20.0	X	○
380.0	424.0	20.0	22.0	X	X
380.0	435.0	25.0	27.5	X	○
380.0	438.0	23.0	29.0	X	○
380.0	440.0	25.0	30.0	X	○
381.0	432.0	25.0	25.5	X	○
384.0	414.0	15.0	15.0	X	○
384.0	428.0	20.0	22.0		X
385.0	430.0	25.0	22.5	X	○
385.0	438.0	32.0	26.5	X	○
387.0	431.0	22.5	22.0	X	X
390.0	420.0	14.0	15.0	X	○
390.0	420.0	16.0	15.0	X	○
390.0	430.0	18.0	20.0	X	○
390.0	430.0	20.0	20.0	X	○
390.0	434.0	19.2	22.0	X	○
390.0	434.0	20.0	22.0	X	X
390.0	440.0	22.0	25.0		X
390.0	464.0	20.0	37.0		X
395.0	430.0	18.0	17.5	X	X
395.0	431.0	18.0	18.0	X	○
395.0	439.0	20.0	22.0	X	X
400.0	438.0	17.5	19.0	X	○
400.0	440.0	14.0	20.0		X
400.0	440.0	18.0	20.0	X	○
400.0	440.0	20.0	20.0	X	X
400.0	444.0	19.2	22.0	X	○
400.0	444.0	20.0	22.0	X	X
400.0	445.5	22.0	22.7	X	○
400.0	450.0	20.0	25.0	X	○
400.0	450.0	22.0	25.0	X	X
405.0	455.0	22.0	25.0	X	○
410.0	450.0	18.0	20.0		X
410.0	450.0	20.0	20.0	X	○
413.0	455.0	20.0	21.0	X	○
415.0	445.0	20.0	15.0	X	○

"X" Tools available.

"○" As special part available on request.

Dimensions printed in **bold** are preferred sizes. Further sizes on request.